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THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

PRELIMINARY ANNOUNCEMENT OF THE SUMMER MEETING TO BE HELD IN CHICAGO FROM JUNE 19 TO 30, IN CON- NECTION WITH THE CENTURY OF PROGRESS EXPOSITION

Edited by Professor HENRY B. WARD
PERMANENT SECRETARY

THIS year the summer meeting of the American Association for the Advancement of Science is exceptional in character and importance. It is to be held in Chicago, the great metropolis of the Mid West; it is to cover twice the usual period, the time this year extending from June 19 to 30, inclusive; it welcomes as guests scientists from other lands; it is signaled by programs embracing contributions by leaders in scientific research from the nations of the world.

Recognizing the significance of this occasion, the secretaries of the sections and of the affiliated societies have been for months devoting special attention to organizing programs depicting in each field the progress of science in the past and the outlook for

its future service to the nation and the world. No summer meeting previously held in this country has offered to students of science or to the public interested in scientific advancement an opportunity as rich and varied as that embodied in the plans now announced for this meeting.

First of all the location is peculiarly appropriate for such a gathering. A century ago this region was on the edge of the wilderness. In 1833 Chicago was incorporated as a frontier city; this year, as a great metropolis, it celebrates its centenary in a manner calculated to emphasize the tremendous progress which, in common with the nation, it has made in a hundred years. Its marvelous development is based

on the advancement of science. The Century of Progress Exposition, conceived, planned and carried to successful realization despite tremendous difficulties in the immediate past, offers to the association concrete demonstrations of the advancement of science in variety and extent heretofore un essayed by any organization or community in the world. The unique character of the exposition will be apparent to all who participate in the meetings.

Working together the Century of Progress and the association issued last year invitations to a selected list of leaders in scientific research throughout the world to visit Chicago and take part in the programs of the meeting. Acceptances were received from about forty and their contributions appear in the general program of the meeting outlined later in this announcement. In consequence of the presence and participation of these foreign guests together with many distinguished men from this continent, the meeting takes the form of an international congress. It affords a rare opportunity for personal contacts and exchange of views on the progress of science here and elsewhere which will be of the highest value to American workers and will stimulate increased activity in these fields.

The list of foreign guests, as already printed in *SCIENCE* for November 25, 1932 (p. 484), has suffered only slight modification due to various circumstances. The speakers and their topics so far as announced are given later in this article in the record of meetings and general sessions.

The period of two weeks decided upon for the meetings is well filled by the programs of the sections and of the participating societies. While it has not been possible to group together all similar organizations, still the first week in general is being utilized by societies representing pure sciences, whereas those in applied sciences meet in the second week. The number of affiliated societies meeting with the association is unexpectedly large; indeed, the group of engineering societies is so large that this period has rightly been designated as Engineering Week. Relations to the organizations have determined the precise time for certain special groups; thus the meetings of Section N (Medical Sciences) come in the first week, immediately after the convention of the American Medical Association in Milwaukee, and those of Section Q (Education) fall at the end of the second week, thus leading up to the sessions of the National Education Association immediately following.

To a large extent the programs of the sections and the affiliated societies have assumed a special character for this occasion. Many symposia have been organized which merit particular attention, as they include addresses by the foreign guests and by American scientists of distinction. Single addresses and

short series of invited papers dealing with particular problems have been preferred to miscellaneous lists of contributed papers. An effort has been made to leave time open, especially in the afternoons, which can be used for group conferences, informal discussions and social affairs.

The evenings have been devoted to a series of general sessions, with programs of wide general interest and speakers in fields commanding present attention. Most of these programs are announced under the auspices of some section and are planned definitely to appeal to the general membership of the association, both by nature of the topics presented and of the speakers. It is the hope of the association that these occasions may also attract such attention from the citizens of Chicago and vicinity as will make known the work of the association and the significance of science as the essential factor in determining progress in the coming century. While the list of events is still subject to slight modification, the series of evening sessions will be substantially as follows.

EVENING MEETINGS

On Monday evening, June 19, the Century of Progress Exposition will tender a reception to the association and associated societies in honor of the foreign guests. This reception will be held in the Hall of Science on the Exposition Grounds. Admission will be by badge or ticket only. Members should not fail to register sufficiently early to secure the necessary items.

On Tuesday evening, June 20, Section N (Medical Sciences) has organized a general session for the association and its friends. The program will be devoted to the topic of "A Century of Progress in Medicine." The public is invited. The speakers include: Dr. Morris Fishbein, editor of the *Journal* of the American Medical Association, on "Frontiers of Medicine"; Dr. Paul Dudley White, of the Harvard Medical School, on "Heart Disease"; Dr. Max Cutler, of the Michael Reese Hospital, on "The Conquest of Cancer"; Madame Curie, of Paris, will also take part. This meeting will be held in a large auditorium, the location of which will be announced later.

On Wednesday evening, June 21, the general session will be conducted under the auspices of Section B (Physics). The speakers will include Dr. F. W. Aston, of Cambridge, England, on "The Story of Isotopes," and President R. A. Millikan, of the California Institute of Technology, on "New Light on Nuclear Physics."

The same evening Section F has provided another general session, with Dr. Richard Goldschmidt as speaker, on the topic "Some Aspects of Evolution."

Thursday evening, June 22, will be devoted to a

banquet given by the association in the Grand Ball Room of the Hotel Stevens in honor of foreign guests. Members desiring tickets for themselves and friends should make early reservation. Attendance at the banquet is also open to friends of the association, after provision has been made for members desiring to participate. Further details will be announced in the general program.

On Friday evening, June 23, there will be a general session at the Field Museum under the auspices of Section H (Anthropology), in which Professor C. U. A. Kappers, director of the Central Institute for Brain Research, Amsterdam, Holland, will give an address on "The Anthropology of the Near East in Connection with the History of its Population." On this evening the Field Museum will hold an open house for the members of the association and their guests.

Section I (Psychology) sponsors a general session for Saturday evening, June 24, in which Professor Charles E. Spearman will speak on "Recent Advances in Our Knowledge of Human Personality."

On Monday evening, June 26, comes a symposium arranged with the cooperation and support of the Far Reaching Foundation of Denver. The program on the subject "Nationalism" has been worked out by a special committee of Section L (History and Philology). Professor Charles A. Beard, president of the American Historical Association, will present a paper on "Nationalism in American History." Professor Bernadotte Schmitt, of the University of Chicago, will also speak. It is hoped that one or more of the foreign guests will take part.

On Tuesday evening, June 27, Section M (Engineering) and the engineering societies will hold a joint general session in the Grand Ball Room of the Palmer House. Dr. A. P. M. Fleming, of the Metropolitan Vickers Electrical Company, Manchester, England, will address the session on "The Development of Engineering in the Last One Hundred Years."

Wednesday, June 28, is recognized by the Century of Progress Exposition as Engineers' Day. The general banquet of the engineering societies and Section M will be held that evening in the Grand Ball Room of the Hotel Stevens.

Thursday evening, June 29, Section K (Social Sciences) will sponsor a general session. Professor Henry Clay, of Manchester, England, will deliver the address of the occasion.

Friday evening, June 30, the general session is held under the auspices of Section Q (Education). The topic of the evening is "Education for a Democracy." Professor Walter F. Dearborn, of Harvard University, will preside. Miss Jane Addams, of Hull House, Chicago, and President Robert M. Hutchins, of the University of Chicago, will speak.

Certain other special features in the general program merit particular mention. Among these is the conference on "The Diffusion of Scientific Knowledge," organized by Science Service under the leadership of Dr. William H. Howell. The wide-spread and unfortunate failure of the general public to recognize the fundamental importance of research as a *condicio sine qua non* of advancement in the well-being of all nations and the necessity of maintaining and increasing rather than reducing and crippling such activities at the present time make this topic of outstanding importance. The discussion by a group of distinguished foreign scholars from widely different environments is certain to yield results of great value.

The meeting of the American section of the International Union of Pure and Applied Sciences with foreign guests will convene on Saturday morning, June 24, in the International House on the University of Chicago campus, under the leadership of President R. A. Millikan, chairman of the union, and Professor F. K. Richtmyer, of Cornell University, chairman of the section. The program includes papers by Sir Richard Glazebrook, M. Henri Abraham, professor at the Sorbonne, Professor Leigh Page, of Yale University, Dr. George A. Campbell, of the American Telephone and Telegraph Company, Dr. Harvey L. Curtis, of the U. S. Bureau of Standards, and Professor A. E. Kennelly, of Harvard University.

On Tuesday afternoon, June 27, the American Society for Testing Materials has arranged for a joint meeting with Section M (Engineering). On this occasion the Edgar Marburg Lecture will be given by Dr. Herbert John Gough on "The Crystalline Structure in Relation to Failure of Metals, Especially by Fatigue." In 1925 the American Society for Testing Materials instituted the Marburg Lecture for the purpose of securing at annual meetings, by leaders in the respective fields, reports of outstanding developments in the promotion of knowledge of engineering materials. The lecture commemorates the name of the first secretary of the society, through whose development of the technical programs the organization has become widely recognized as a forum for the discussion of properties and tests for engineering materials.

Important symposia and more technical addresses by distinguished foreign guests and others have been developed by many sections and societies and are listed for meetings during the afternoon hours and in connection with society dinners. A record of these items will be found under the programs of the organizations concerned.

On Sunday morning, June 25, members of the association are invited to attend services in the University of Chicago Chapel. The address will be given by Professor Shailer Mathews. It is hoped that special

courtesies can be offered to the association on Sunday afternoon also, of which later notice will be given.

ENTERTAINMENT FOR LADIES

Mrs. Henry Gale, chairman of the Ladies' Committee, has reported the present stage of plans for entertaining the ladies while their husbands are attending the scientific sessions. On Wednesday, there will be an automobile trip up the North Shore, luncheon and visits to two or three private gardens, with tea; on Thursday afternoon, a visit to the University of Chicago campus, with tea at the Ida Noyes Hall; in the late afternoon, probably on Friday, a boat trip on the lake in private boats of Chicago yachtsmen. For at least the first and last of these functions the parties will be limited in number. Plans for registering for them will be announced in the printed programs for the meetings, along with plans for visiting other points of interest in Chicago by individual request, guest memberships at the women's clubs, etc.

THE CENTURY OF PROGRESS EXPOSITION

(From the Exposition office through the courtesy of Dr. Philip Fox)

The Century of Progress Exposition, in addition to having a historical background, will show the latest industrial developments and the basic scientific principles behind them. A replica of Fort Dearborn, Chicago's first building, is seen there, and with a turn of the head the lofty skyscrapers of America's foremost contribution to architecture, which had its inception in Chicago.

The general type of exhibits of the Basic Science Division was outlined by the Science Advisory Committee of the National Research Council. The exhibits are intended to present a unified front of modern science, but for operating purposes they are classified under the following seven heads—Mathematics, Astronomy, Physics, Chemistry, Biology, Geology and Medicine. The exhibits are for the most part presented in the Hall of Science. They are designed to be intelligible and appealing to the uninitiated and at the same time of interest to the specialist.

In the field of biology, every resource at command will be enlisted to present in clear and simple fashion a few of the fascinating problems and principles of that science. Living plants and animals will be used in the demonstration of the principles of genetics, evolution, ecology and animal societies. The rôle of the cell will be emphasized. Cell activities will be demonstrated and illustrated by models of magnified cells. So far as possible the demonstrations will be made by means of moving models, living specimens, moving pictures and transparencies, as well as preserved

plants and animals. Among highly interesting presentations will be the embryological exhibits, the models displaying the physical mechanism of speech and thought, the union of plant cells, the production of food in plants, the growth of trees, marine biology, the distribution of plant life over the globe, etc.

Chemistry will be presented as the fundamental science of the transformation of matter. The exhibits will attempt to demonstrate what chemistry is and what it has done to advance civilization. Such phenomena as burning, the rusting of metals, the combustion of fuels, the function of breathing, etc., will be shown as various manifestations of chemical change. The development of the world's raw materials and their production by means of chemical transformation into articles and commodities of vital necessity to mankind will be shown. The principle of catalysis and its application to the production of useful products, the application of the principle of absorption and the study of colloidal matter and the products which have resulted will likewise be portrayed. Important chemical applications of electricity will be demonstrated.

In the geological exhibits the origin and growth of the earth will be traced by means of operating models and other dynamic exhibits. How the processes of deposition and erosion have changed the earth's contours will be shown. The formation of mountain ranges, how volcanoes and geysers occur and the origin and recording of earthquakes will be explained. Petroleum's occurrence in the earth and man's amazing methods of locating it will be shown by a series of exhibits. A geological time clock, which records 2,000,000,000 years of the earth's history within the space of a few minutes, will be another unique feature of this exhibit.

Visitors will be given a broad and comprehensible view of mathematics. This science, for purposes of clarity in the exhibit, has been divided into four major subdivisions: numbers and algebra, geometry, analysis and applied mathematics. Historic apparatus and instruments used by the U. S. Navy in navigation, gunnery and communication will be on display. The contributions of mathematics to the development of other basic sciences will be interestingly set forth.

In the exhibits of physics, visitors will learn of a wide variety of phenomena—how gases can exert high pressure, how gas and steam engines and refrigerating systems operate, how drops of water and other liquids happen to be round, how sounds are produced, transmitted through the air and recorded. Fundamental electrical phenomena will be demonstrated, and the application of electricity and magnetism to industrial uses for man's welfare will be clearly set forth. One of the interesting features of the exhibits of physics

will be an optical section which reveals refraction of light by prisms and lenses, colored effects produced in various ways and important spectra.

The astronomical exhibit is housed in the Adler Planetarium and Astronomical Museum, which contains an unexcelled collection of antique astronomical and mathematical instruments for observation and computation. The chief exhibit is the Zeiss Optical Planetarium. No instrument has been devised which has greater versatility in exhibiting the phenomena of any science.

The medical sciences will tell the story of the control of pain, of the doctor's service to the sick, of antiseptics and asepsis in surgery, the discovery of the x-ray, the extension and clarifications of man's vision by means of the microscope, the progress of medicine from the saddle-back doctor of 1833 to the scientific practitioner of to-day. One of the striking features of the medical exhibit will be the transparent man—a heroic model of the human body, showing the skeletal, nervous, vascular, respiratory, digestive and muscular systems.

Outdoor and indoor exhibits will come to tell a complete story of social science, tracing the life of man from earliest times to the present. In the outdoor area groups of Indians will live their native life as closely as possible. This exhibit will culminate in a reproduction of one of the great Maya buildings of Yucatan—the highest development of American aboriginal culture.

The indoor exhibits will be housed in the Hall of Social Science. A central exhibit—the American family—sets the keynote for the stories of education and social work. The dramatic story of anthropology begins a huge relief map showing the nine cultures of North America.

Another display tells how the story of the past is read: once read it becomes history. This in turn leads to the exhibits in psychology and sociology and on to statistics, economics and political science. In the section on education is shown the development of the American School in response to American needs.

The record of agriculture and engineering, too extensive even to be summarized here, is shown in appropriate buildings. To the engineers the exhibits in the Electrical Building and Transportation Building will be of special interest. The type of construction in many of the buildings also presents some novelties. In addition there are separate exhibits by the great industrial concerns.

POINTS OF INTEREST AND EXCURSIONS

(By courtesy of the local committee)

There are numerous points of interest in and about Chicago for its visitors. The city is being built on a

definite program, which has as its slogan Daniel H. Burnham's injunction: "Make no little plans." The park and boulevard systems, the forest preserves, the reversal of the Chicago River as an item toward the sanitation of Chicago and the development of the Lakes-to-Gulf Waterway are integral parts of the plan.

One should visit the Art Institute, the Field Museum of Natural History, the Adler Planetarium and Astronomical Museum, the Museum of Science and Industry (which in its present form preserves the beauty of the Fine Arts Building of the Columbian Exposition), the Shedd Aquarium, the Oriental Institute, the Zoological Gardens, the Chicago Historical Society Building, the Museum of the Chicago Academy of Sciences and the educational institutions, principally the University of Chicago and Northwestern University.

If interested in the world's food supply, visit the International Harvester plant, the Stock Yards and the Board of Trade. One may visit also the steel center in South Chicago and Gary, the oil-refining plants in Whiting, the great merchandising plants of Sears-Roebuck and Montgomery Ward, the Merchandise Mart, great stores, of which Marshall Field's is the premier, the banking center of LaSalle Street and the great printing establishment of the Lakeside Press.

The Sand Dunes at the south end of Lake Michigan, Lake Geneva with the botanical gardens and the Yerkes Observatory, or farther, the Dells of Wisconsin, provide attractive excursions; likewise, short lake trips or boat trips across the lake and to Milwaukee.

THE AMERICAN ASSOCIATION PRESS SERVICE

(By Austin H. Clark)

The aim of the Press Service is to assist in presenting to the public through the press a true and accurate story of the development of science in this country. Naturally the development of science, as portrayed in the press from year to year, is to a large extent comparable to a history of the scouts and advance guards of an army rather than to the more methodical progress of the army itself.

When we who are engaged in science delve into history we like to read of the more spectacular events, and we are prone to evaluate history on the basis of a scattered and more or less disconnected series of such events, more or less completely ignoring the more prosaic social trends that gave these events their significance or made them possible.

To one who really knows history the average man's idea of historical events seems just as far afield from a proper conception of the basic fundamentals as science in the press seems to the scientific man. Both

science and history, when brought before the public, must be presented in terms that interest the public and that the public understand. The public is not interested in the slow progress of a great army or in the progress of the great mass of scientific workers. But it is interested in results, especially spectacular results.

We who are engaged in scientific work are fortunate in having the results of our labors presented in the press by a corps of able and conscientious writers in whom we are justified in placing complete confidence. If, in order to interest the public, these writers must lay emphasis on points that are quite different from the points that we in talking among ourselves would emphasize, that is their responsibility. So long as what they write is accurate, we have no valid reason for objection. This fact is now very generally realized and appreciated.

At Chicago the functions of the Press Service will be carried on as heretofore. Those who are to present papers are asked to send two copies of their manuscripts, each accompanied by an abstract, to the American Association for the Advancement of Science Press Service, Smithsonian Institution Building, Washington, D. C., as far in advance of the meeting as possible. A single copy of the manuscript will not suffice, and both copies are to be sent to the same address.

The manuscripts sent to the Press Service are not for publication as such. They are solely for the use of the press representatives in the preparation of news items or features. They are regarded as confidential, and except for the properly accredited press representatives no one is allowed access to them.

So far as possible the Press Service endeavors to supply the press with such additional information as will be advantageous in the proper presentation of a news item, and it also aids the press in securing interviews with authors when such interviews are requested.

The press is by far the most important medium for the diffusion of scientific knowledge among the people as a whole. It has become the outstanding factor in the education of those beyond school age and is an increasingly important factor in broadening the knowledge and interests of those still in school.

The press is conscientiously doing its best to make as accurate and as timely as possible the information that it presents. It is becoming increasingly important that we who are occupied with scientific work should do all we can to help it.

MEMBERSHIP

The unusual privileges accorded members at the Chicago meeting make it desirable for all to register early to receive the full program and the badge which

will admit to the various special functions. Registration on this occasion will be handled at the Stevens Hotel and at branch registration offices in Eckhardt Hall, University of Chicago, and in Thorne Hall, McKinloch Campus, Northwestern University.

Since it was felt that many in the Middle West would desire to participate in this meeting and enjoy especially the privileges of contact with the distinguished foreign guests, a special invitation has been extended to those living within 300 miles of Chicago to join the association at this time without payment of the usual initiation fee. Persons desiring to take advantage of this offer should address the Washington office in advance or make application at any registration desk during the meeting.

INVITED GUESTS

Scientific men or women coming from outside the United States and Canada who are not members of the association may be welcomed as guests for the meeting. Information concerning such persons should be sent to the permanent secretary's office in Washington or later to him at the Stevens Hotel, Chicago. Full data are desired that the cases may be properly presented to the executive committee and official invitations duly authorized and issued.

BUSINESS SESSIONS

The council is charged with the duty of handling the business of the association and has provided that all matters offered for its consideration be referred first to the executive committee for study and formulation. Any items may be sent to the Washington office up to June 10. After that date they should be sent to the Chicago headquarters, Hotel Stevens, in care of the permanent secretary. The executive committee will meet in the Stevens Hotel on Monday, June 19, at 10 A. M., to review items previously presented and to prepare the agenda for the council. The first council meeting will be held on Monday afternoon at 2 P. M. Subsequent meetings of the council will be held at 9 A. M. on Tuesday and Wednesday, and thereafter if necessary. The executive committee will also meet daily to care for business matters that may demand attention. In view of the difficulties necessarily associated with careful consideration of important questions it is desirable that all proposals be left with the permanent secretary as early as feasible.

HOTEL HEADQUARTERS AND TRANSPORTATION

Data regarding hotel headquarters were printed in *SCIENCE* for May 12. Reduced railway rates by the "certificate plan certificate" have been granted by almost all railroads in the United States and Canada. Persons attending the meeting should purchase a first-

class one-way ticket to Chicago, securing a "certificate plan certificate" reading "for the American Association for the Advancement of Science and Associated Societies." The certificate must be left at the validation desk in the registration offices to be called for later at the same place. Each person presenting an endorsed and validated certificate may purchase a continuous passage, one way return ticket for *one third* of the regular fare by the same route as that traveled to Chicago. Certificates must be validated before July 4. Tickets to Chicago must be purchased between June 15 and June 28 (both dates inclusive). Return tickets must be purchased by July 4; having purchased the return ticket its holder can remain in Chicago at will, provided he reaches the original starting point within thirty days.

Special fares of varied character have already been announced by certain lines and probably more such will be offered before the date of our meetings. Information about these rates and the precise conditions of issue and use may best be secured from your local agent. Early application is advisable. It is likely that special ten-day rates will be preferable, except for persons desiring to make a longer stay in Chicago.

SCIENTIFIC SESSIONS OF SECTIONS AND SOCIETIES

Sections are arranged in the order of the alphabetic designations used in the association's records. Affiliated societies are given the letter of the section under which each is listed, together with a distinguishing number. The president and secretary of each society are named, and they represent the organization on the council of the association, unless other representatives have been elected and are present to serve at Chicago. It is hoped that the societies may all be well represented at council meetings in order to facilitate prompt and proper transaction of business.

The programs as outlined are not complete, but they are in the main correct and adequate to give a true conception of the final program.

A—Mathematics

- A-1. Section A of the Association. June 21-23.
Vice-president, Charles N. Moore; *Secretary*, E. R. Hedrick.
- A-2. American Mathematical Society. June 19-23.
President, L. P. Eisenhart; *Secretary*, R. G. D. Richardson.
- A-3. Mathematical Association of America. June 20-23.
President, E. T. Bell; *Secretary*, W. D. Cairns.

The program of the American Mathematical Society will open on Monday, the morning being devoted to registration and the afternoon to a session of con-

tributed papers. On Tuesday morning there will be another session of contributed papers. On Tuesday afternoon the Mathematical Association of America is planning a program at which the following papers will be presented: "The Postulation Method in Mathematics," by Professor E. V. Huntington, of Harvard University; "The Lag of Mathematics behind Literature and Art in the Early Centuries," by Professor H. E. Slaughter, of the University of Chicago; "Applications of Mathematics to Real Estate Problems," by Dr. Henry Babcock, of Evanston. On Wednesday morning Section A and the American Mathematical Society will hold a joint symposium, at which Professor Lipot Fejer, of the University of Budapest, will speak on "The Infinite Sequences Arising in the Theories of Harmonic Analysis, of Interpolation and of Mechanical Quadratures," and Professor C. N. Moore, of the University of Cincinnati, will give a paper entitled "On the Use of Cesaro Means in Determining Criteria for Fourier's Constants." One other speaker has been invited to participate in this meeting. Wednesday afternoon will be devoted to a joint session of Section A and the society, at which invited addresses on geometry will be given. Professor Levi-Civita, of the University of Rome, will speak on "Nets on a Surface and Extension of Trigonometry," and Professor W. C. Graustein, of Harvard University, will give a paper entitled "Invariant Methods in Differential Geometry." Two other speakers have been invited to participate. On Thursday morning the American Mathematical Society will hold a meeting devoted to short contributed papers. For Thursday afternoon the Mathematical Association of America is planning a program in which the following men will present papers: Dr. T. C. Fry, of the Bell Telephone Laboratories, on "Fundamental Concepts in the Theory of Probability"; Professor George D. Birkhoff, of Harvard University, on "Mathematics and Art"; Dr. D. H. Lehmer, of the California Institute of Technology, on "A Number Theory Machine." On Friday morning there will be a joint session of Section A and the American Mathematical Society, at which Professor Levi-Civita will give a lecture on "Some Mathematical Aspects of the New Mechanics" and Professor G. D. Birkhoff on "Quantum Mechanics and Asymptotic Series." This meeting will be of special interest to the members of the American Physical Society, although they are not meeting jointly with Section A. For Friday afternoon the American Mathematical Society has arranged for a lecture by Professor L. E. Dickson, of the University of Chicago, on "Recent Progress in Additive Number Theory," which will be followed by short papers on number theory. A dinner for the mathematicians is planned for Friday evening.

B—Physics

- B-1. Section B of the Association. June 19-24.
Vice-president, C. J. Davisson; *Secretary*, H. A. Barton.
- B-2. American Physical Society. June 19-24.
President, Paul D. Foote; *Secretary*, W. L. Severinghaus.
- B-3. American Meteorological Society. June 19-20.
President, Herbert H. Kimball; *Secretary*, Charles F. Brooks.

On Monday morning, June 19, Section B and the American Physical Society will have a program of short contributed papers. The American Meteorological Society will hold a meeting devoted to papers on "A Century of Progress in American Meteorology," at which the following papers will be presented: "Pioneers in American Meteorology and the Founding of Weather Services," by Mr. Eric R. Miller, of the U. S. Weather Bureau at Madison; "The Early History of Aerology in the United States," by Mr. S. P. Fergusson, of Harvard University; "History of the Application of Meteorology to Aeronautics with Special Reference to the United States," by Mr. W. R. Gregg, of the U. S. Weather Bureau at Washington; "On the Dynamics of Penetrative Convection," by Dr. J. Bjerknes, of the Geophysical Institute, Bergen, Norway; "Periodicities in Rainfall," by Professor Dinsmore Alter, of the University of Kansas. On Monday afternoon the American Meteorological Society will hold a symposium on "Radiation and General Circulation of the Atmosphere." Dr. H. H. Kimball, of Harvard University, will present a paper on "Solar Radiations as a Meteorological Factor"; Dr. W. J. Humphreys, of the U. S. Weather Bureau at Washington, a paper on "Incoming and Outgoing Radiation as Affected by the Atmosphere"; Dr. J. Bjerknes, on "A Theory of the General Circulation of the Atmosphere." Mr. John Patterson, of the Meteorological Office in Toronto, will also present a paper. On Tuesday morning Section B and the American Physical Society, with Section C as their guests, will hold a symposium on "Application of Quantum Mechanics in Chemistry," with the following speakers: Professor J. C. Slater, of the Massachusetts Institute of Technology, on "Electron Energies in Atoms and Molecules"; Professor Linus Pauling, of the California Institute of Technology, on "Quantum Mechanics of Condensed Ring Systems, Free Radicals and Other Complex Molecules"; Dr. Henry Eyring, of Princeton University, on "Quantum Mechanics and Chemical Reactions"; Professor R. S. Mulliken, of the University of Chicago, on "Band Spectra and Molecular Structure." The American Meteorological Society will hold a symposium on "Dynamics of Extratropical Cyclones." Dr. J. Bjerknes will present a paper on

"Vertical Cross Sections through Extratropical Cyclones"; Mr. Andrew Thomson, of the Meteorological Office in Toronto, will present a paper on "The Cyclone of November 18-19, 1931"; Dr. W. J. Humphreys, on "Origins of Extratropical Cyclones"; Mr. K. O. Lange, of the Massachusetts Institute of Technology, on "Atmospheric Soundings for Glider Meets"; Mr. Phil E. Church, of Mooseheart, Illinois, on "Dynamic Climatology from the Massachusetts Institute of Technology Weather Maps"; Professor T. A. Blair, of the U. S. Weather Bureau at Lincoln, Nebraska, on "Interrelations of Seasonal Weather, Pacific Ocean and North America"; an additional paper by Professor C. G. Rossby, of the Massachusetts Institute of Technology. On Tuesday afternoon the American Meteorological Society will hold a meeting devoted to miscellaneous papers. The following men will present papers: Dr. H. H. Kimball, of Harvard University, and Mr. I. F. Hand, of the U. S. Weather Bureau at Washington, on "The Use of Glass Color Screens in the Study of Atmospheric Depletion of Solar Radiation"; Mr. Bernard Haurwitz, of the University of Leipzig, and Mr. Harry Wexler, of the Massachusetts Institute of Technology, "Turbidity of American Air Masses according to Linke's and Ångström's Measures of Turbidity"; Mr. S. P. Fergusson, of Harvard University, on "Anemometer Experiments." Section B and affiliated societies will hear an address by Dr. J. Bjerknes on "Atmospheric Soundings, Methods and Results." On Wednesday morning Section B and the American Physical Society will meet with Section C in a symposium on "Isotopes" (see announcement of Section C). On Wednesday afternoon Section B and the American Physical Society will participate in a joint symposium with Sections C, D and E on "Measurements of Geologic Time" (see announcement of Section E). Following the symposium, Professor Enrico Fermi, of the University of Rome, will give an address on "Theory of Hyperfine Structures." In the evening the American Physical Society will hold a dinner, which will be followed by a general session. On Thursday morning Section B and the American Physical Society with Section D will hold a joint symposium on "Spectroscopy and Astronomy" (see announcement of Section D). On Thursday afternoon Section B and the American Physical Society will meet for a lecture by Professor N. Bohr on "Space and Time in Contemporary Physics." On Friday morning Section B and the American Physical Society will hold a symposium on "Nuclear Disintegration." Professor E. O. Lawrence, of the University of California, will speak on "Recent Work on Nuclear Disintegration at the University of California"; J. D. Cockcroft, of the University of Cambridge, England,

on the "Disintegration of Light Elements by High Velocity Protons"; Dr. M. A. Tuve, of the Department of Terrestrial Magnetism at Washington, on "Disintegration Experiments on Elements of Medium Atomic Number"; Professor W. D. Harkins, of the University of Chicago, on "Disintegration of Nuclei by Neutrons." The members of Section B will be interested in the program which Section A has arranged for Friday morning. In the afternoon Professor A. Sommerfeld, of the University of Munich, will give an address on "Theory of Metallic Conduction." On Saturday morning Section B is meeting with the American Section of the International Union of Pure and Applied Physics.

C—Chemistry

C-1. Section C of the Association. June 19-23.

Vice-president, Arthur B. Lamb; *Secretary*, J. H. Simons.

C-2. American Chemical Society. June 23.

On Monday morning Section C will hold a joint symposium with Section N on "Colloid Chemistry Related to Biological Problems." Professor Theodor Svedberg, of Upsala University, Sweden, will present a paper on "Sedimentation Constants and Molecular Weights of the Respiratory Proteins." Professor Filippo Bottazzi, of Naples, Italy, will present a paper on "Physico-Chemical Properties of Concentrated Blood Serum." Additional papers will be presented by the following: Professor Edwin J. Cohn, of the Harvard Medical School, on "Electrostatic Forces in Systems Containing Biological Components"; Professor J. W. McBain, of Stanford University, on "Some Experimental Methods Applicable to Biological Problems"; Professor W. J. V. Osterhout, of the Rockefeller Institute for Medical Research, on "Cell Physiology in Relation to Colloidal Structure." On Tuesday morning, Section C will meet in a joint session with Section B and the American Physical Society at a symposium on "Application of Quantum Mechanics in Chemistry" (see announcement of Section B). On Thursday, Section C and the Chicago Chemists Club will have a luncheon at the International House, which will be followed by brief informal and non-technical talks. On Wednesday morning, Section C will hold a joint symposium with Section B and the American Physical Society on "Isotopes"; Dr. F. W. Aston, of Cambridge, England, will present a paper on "Some Measurements of Relative Abundance of Isotopes"; papers will also be presented by Dr. K. T. Bainbridge, Bartol Research Foundation of the Franklin Institute, on the "Masses of Isotopes and the Disintegration of Atoms"; Dr. E. W. Washburn, of the U. S. Bureau of Standards, on "Isotopic Fractionation of Water";

Professor Fred Allison, of the Alabama Polytechnic Institute, on the "Magneto-Optic Method in the Study of Isotopes"; Professor W. D. Harkins, of the University of Chicago, on "Neutrons and Isotopes" and Professor H. C. Urey, of Columbia University, on "Diffusion Method of Separation of Isotopes." On Wednesday afternoon Section C will meet with Sections B, D and E in a symposium on "The Measurement of Geologic Time" (see announcement of Section E). The American Physical Society is holding a dinner on Wednesday evening, which will be of interest to members of Section C. On Thursday morning Section C will hold a session devoted to contributed papers. On Friday morning Section B is holding a symposium on "Nuclear Disintegration," which will interest members of Section C. In the evening Section C and the Chicago Section of the American Chemical Society are holding a dinner at the Midland Club. Professor Theo. Svedberg, of Upsala University, Sweden, will give the principal address on "Sedimentation of Molecules in Centrifugal Fields."

D—Astronomy

D-1. Section D of the Association. June 21-24.

Vice-president, V. M. Slipper; *Secretary*, H. T. Stetson.

D-2. American Astronomical Society.

President, W. S. Adams; *Secretary*, R. S. Dugan.

On Wednesday afternoon, June 21, Section D and the American Astronomical Society will meet with Sections B, C and E in a symposium on the "Measurement of Geologic Time" (see announcement of Section E). On Thursday morning Section D and the American Astronomical Society will participate in a joint symposium with Section B and the American Physical Society on "Spectroscopy and Astronomy." Professor A. Sommerfeld, of the University of Munich, will speak on the "Present Status of Spectroscopic Theory"; Professor W. S. Adams, of the Mt. Wilson Observatory, on "Spectroscopy as a Tool in Astronomy"; Dr. I. S. Bowen, of the California Institute of Technology, on "Spectra of Highly Rarefied Gases"; Professor Otto Struve, of Yerkes Observatory, on "Matter in Interstellar Space." On Thursday afternoon Section D and the American Astronomical Society will attend the lecture by Professor N. Bohr, of the University of Copenhagen, on "Space and Time in Contemporary Physics." On Friday and Saturday mornings Sections D and the American Astronomical Society will hold sessions at the Adler Planetarium, devoted to miscellaneous papers contributed by members. On Saturday afternoon an excursion will be made to the Yerkes Observatory.

E—Geology and Geography

- E-1. Section E of the Association. June 20-22.
Vice-president, R. T. Chamberlin; *Secretary*, Kirtley F. Mather.
- E-2. Geological Society of America. June 20-22.
President, Reginald A. Daly; *Secretary*, Charles P. Berkey.

On Tuesday morning Section E and affiliated societies have arranged a session, at which Professor J. J. Sederholm, of Helsingfors, Finland, will speak on "Ultrametamorphism and Anatexis." Dr. R. J. Tillyard, of Australia, will present a paper on "A New Class of Arthropods from the Precambrian of the Adelaide Series, South Australia." Dr. Arthur Bevan, of the University of Virginia, will speak on "Recent Studies of the Paleozoic Formations in Virginia." On Tuesday afternoon Professor J. J. Sederholm will give an address on "Progress and Scope of Precambrian Research." In the evening an informal dinner will be held for geologists and geographers. It is hoped that Sir Douglas Mawson, of England, will be present and that he will speak after the dinner. On Wednesday afternoon Section E will hold a joint symposium with Sections B, C and D on "The Measurement of Geologic Time," at which the following papers will be presented: "General Survey of the Problem," by Dr. Alfred C. Lane, of Tufts College; "Working Formulae for the Age of a Radioactive Mineral," by Professor A. F. Kovarik, of Yale; "The Significance of the Isotopes of Uranium and Lead," by Dr. C. S. Piggot, of the Geophysical Laboratory; "The Actinium Series of Radioactive Elements and the Measurement of Geologic Time," by A. V. Grosse, of the University of Chicago; "The Helium Method, a New Outlook," by W. D. Urry, of the Massachusetts Institute of Technology; "Thorianite from Eastern Pennsylvania," by Dr. R. C. Wells, of the U. S. Geological Survey; "Post-glacial Time Calculations from Recent Geothermal Gradient Measurements in the Calumet Copper Mines," by President W. O. Hotchkiss, of the Michigan College of Mining and Technology, and Professor L. R. Ingersoll, of the University of Wisconsin; "The Radium Content of the Travertine Deposits of Mammoth Hot Springs, Yellowstone Park, as an Index of Their Age," by Dr. Herman Schlundt, of the University of Missouri.

On Thursday morning Section E will hold a joint session with the Geographical Society of Chicago, at which the following men will speak: Professor Charles C. Colby, of the University of Chicago, on "Distribution of World's Major Cities"; Professor Stanley D. Dodge, of the University of Michigan, on "A Plan for the Study of the Regional Geography of the Upper Connecticut Valley"; Professor V. C. Finch, of the University of Wisconsin, on "A Departmental

Program for Geographical Research: Plan and Progress"; Professor Wellington D. Jones, of the University of Chicago, on "A Reconnaissance Map of Metropolitan Chicago." On Thursday afternoon there will be another joint session. Professor K. C. McMurry, of the University of Michigan, will speak on "A Geographical Reconnaissance of the Lower Rio Grande Valley of Texas"; Dr. Richard Hartshorne, of the University of Minnesota, on "Geographic and Political Boundaries in an Area of International Tension: Upper Silesia"; Professor Henry M. Leppard, of the University of Chicago, on "Tyneside"; Professor Glenn T. Trewartha, of the University of Wisconsin, on "Results of Field Reconnaissance in Japan"; Professor R. S. Platt, of the University of Chicago, on "An Air Traverse of Central America."

F—Zoological Sciences

- F-1. Section F of the Association. June 20-23.
Vice-president, A. S. Pearse; *Secretary*, George R. La Rue.
- F-2. American Society of Zoologists. June 20-23.
President, W. C. Curtis; *Secretary*, W. H. Cole.
- F-3. Entomological Society of America. June 22-23.
President, J. J. Davis; *Secretary*, H. B. Hungerford.
- F-4. American Association of Economic Entomologists. June 22-23.
President, W. P. Flint; *Secretary*, A. I. Bourne.

On Tuesday morning, June 20, Section F has arranged a symposium on "Physical and Chemical Changes in Nerve during Activity"; in this Section N will join. Professor G. H. Parker, of Harvard University, will preside. Professor A. V. Hill, of London, will give an address on "The Heat Production of Nerve"; Professor W. O. Fenn, of the School of Medicine and Dentistry of Rochester, will speak on "Nerve Respiration"; Professor R. W. Gerard, of the University of Chicago, on "Chemical Activity of Nerve"; Dr. H. S. Gasser, of Cornell University, on "Electrical Phenomena in Nerve." On Tuesday afternoon, Dr. Joseph Barcroft, of Cambridge, England, will address the section on "Foetal Respiration." On Wednesday afternoon Section F will meet with the American Society of Naturalists and Section O in a symposium on "Heredity" (see announcement of American Society of Naturalists). On Thursday morning Section F, the Entomological Society of America and the American Association of Economic Entomologists will meet to hear a lecture by Dr. R. J. Tillyard, of Australia, on "The Evolution of the Insect." The lecture will be followed by a luncheon for members of both societies of entomologists. On Thursday afternoon Section F will meet with the Ecological Society of America in a symposium on "Life in Deep Water" (see announcement of the Ecological

Society of America). On Friday evening the two entomological societies will hold a dinner for members at the Chicago Women's Club. It is hoped that Dr. Royal N. Chapman, of the University of Hawaii, will give an address on some phase of insect life in Honolulu.

G—Botany

- G-1. Section G of the Association. June 20-22.
Vice-president, Karl M. Wiegand; *Secretary*, Sam F. Trelease.
- G-2. Botanical Society of America. June 20-22.
President, George J. Peirce; *Secretary*, Loren C. Petry.
- G-3. American Phytopathological Society. June 20-22.
President, F. D. Heald; *Secretary*, F. C. Meier.
- G-4. American Society of Plant Physiologists.
President, W. E. Tottingham; *Secretary*, W. A. Gardner.

On Tuesday morning, June 20, Sections G and O, the Botanical Society of America, the Ecological Society of America, the American Society of Plant Physiologists and the American Society of Agronomy will hold a joint session. Professor Ludwig Diels, of the University of Berlin, will give an address on "Taxonomy of the Angiosperms"; Sir Daniel Hall, of England, on "Does the Introduction of Wild Plants to Cultivation Induce Variation?" and Professor C. E. Allen, of the University of Wisconsin, on "Polyploidy in the Hepaticae." On Tuesday afternoon the same societies will visit the laboratory and greenhouses of the University of Chicago. For Wednesday is planned an all-day field trip to Warren Forest and Dune Reservation, Michigan. In the morning Sections G and O, the American Society of Agronomy, the American Society of Plant Physiologists and the American Phytopathological Society will hold a meeting devoted to progress in plant pathology during the century. Dr. Jean Dufrénoy, of Brice, France, will present a paper on "Local Immunity in the Plant Cell"; Dr. Neil Stevens, of the U. S. Department of Agriculture, on "The Dark Ages in Plant Pathology, 1832-1872"; Dr. J. C. Arthur, of Purdue University, will speak on "My Memories of Plant Pathologists, 1872-1933." In the afternoon the same societies, under the leadership of Dr. G. B. Ramsey, of the U. S. Department of Agriculture, will take a trip to South Water Markets to study markets pathology problems. For Thursday the Botanical Society of America has planned an all-day field trip to Wychwood, Lake Geneva, Wisconsin, which will be of interest to ecologists. In the morning Sections G and O, the American Phytopathological Society and the American Society of Agronomy will hold a joint session, with Dr. J. C. Arthur presiding. Dr. Otto Appel, of Berlin, will speak. Dr. H. H. Whetzel, of Cornell University,

will present a paper on "A Century of Research in Plant Pathology," and Dr. I. E. Melhus, of the Iowa State College, on "A Century of Plant Disease Control." The American Society of Plant Physiologists will hold a symposium on "Radiation and Plant Growth." In the afternoon Sections G and O, the American Society of Agronomy and the American Phytopathological Society will accompany Dr. H. W. Anderson, of the University of Illinois, to the Cook County Experimental Farm to study truck crop diseases.

F and G—Zoology and Botany

- FG-1 American Society of Naturalists. June 20.
President, R. A. Gortner; *Secretary*, E. W. Lindstrom.
- FG-2. Ecological Society of America. June 20-23.
President, George E. Nichols; *Secretary*, Raymond Kienholz.
- FG-3. American Microscopical Society. June 23.
President, M. J. Elrod; *Secretary*, James E. Ackert.
- FG-4. Phi Sigma Biological Research Society. June 19-21.
Chancellor, Paul B. Sears; *Secretary*, A. I. Ortenburger.

On Monday, Tuesday and Wednesday mornings the Phi Sigma Biological Research Society will hold business meetings. Sessions for presentation of contributed papers will be held on Monday and Tuesday afternoons. The annual banquet will be given on Monday evening. On Tuesday morning, June 20, the Ecological Society will meet jointly with Sections G and O, the Botanical Society of America and the American Society of Agronomy (see announcement of Section G). In the afternoon the same societies will make a trip to the greenhouses of the University of Chicago. In the evening there will be an informal dinner for botanists and ecologists at Ida Noyes Hall, at which Professor Ludwig Diels, of Berlin, will speak on "Plant Geography with Reference to the Pacific Flora." The Ecological Society of America and the Botanical Society of America have arranged an all-day field trip for Wednesday to Michigan dunes and Beach Maple Forest, which will be primarily plant ecology, but also animal ecology. On Wednesday afternoon the American Society of Naturalists, with Sections F and O and the American Society of Agronomy participating, has arranged a symposium on "Heredity." Professor F. R. Lillie, of the University of Chicago, will preside. Professor Richard Goldschmidt, director of the Institute of Experimental Biology of Berlin, will talk on "The Influence of the Cytoplasm on Gene-Controlled Heredity." Professor Sewall Wright, of the University of Chicago, will speak on "Physiological and Evolutionary Theories of

Dominance." The Botanical Society of America has arranged an all-day field trip to Wychwood, Lake Geneva, Wisconsin, which will be of interest to ecologists. On Thursday afternoon the Ecological Society, with Section F participating, has arranged a symposium on "Life in Deep Water." Professor August Krogh, of the University of Copenhagen, Denmark, will speak on "Energetics in Great Depths of the Ocean," which will be followed by papers by Professor C. Juday, of the University of Wisconsin, on "The Centrifuge Plankton Content of the Water"; Dr. E. A. Birge, of the University of Wisconsin, on "The Non-Centrifugable Organic Content of the Water"; Professor A. S. Pearse, of Duke University, on "The Ecology of Deep Water Animals"; Dr. P. S. Galtsoff, on "The Biochemistry of the Invertebrata of the Sea." Dr. V. E. Shelford, of the University of Illinois, will lead the discussion. On Friday the Ecological Society of America will take an all-day field trip to Indiana Dunes, primarily for animal ecology.

H—Anthropology

- H-1. Section H of the Association. June 22-24.
Vice-president, T. W. Todd; *Secretary*, W. M. Krogman.
 H-2. American Anthropological Association.
President, F. C. Cole; *Secretary*, J. M. Cooper.

On Thursday morning Section H and the American Anthropological Association will hold a meeting devoted to the subject of ethnology. The following men will speak: Dr. B. Laufer, of the Field Museum of Natural History, on "The Domestication of Animals"; Dr. M. J. Herskovits, of the Northwestern University, on "The American Negro: a Physical, Cultural and Historical Problem"; Dr. A. R. Radcliffe-Brown, of the University of Chicago, on "Studies in Social Organization"; Professor R. Redfield, of the University of Chicago, on "The Maya Indian: a Study in Acculturation." Thursday afternoon will be devoted to visiting anthropological exhibits of A Century of Progress. On Friday morning will be held a symposium on "Archeological Surveys." Dr. A. T. Olmstead, of the University of Chicago, will speak on "Historical and Archeological Method in the Near East." The following papers will be presented: "Archeological Surveys—National Scope," by Dr. Carl Guthe, of the University of Michigan; "Pictorial Survey of the Mississippi Valley," by Mr. Thorne Deuel, of the University of Chicago; "Archeological Survey of Southern Illinois," by Professor Arthur Kelley, of the University of Illinois. At the Friday afternoon session Dr. E. A. Speiser, of the University of Pennsylvania, will speak on "The Ethnic Background of the Early Civilization of the

Near East"; Professor Leland W. Parr, of the George Washington University, on "Physiological Approaches to the Study of Anthropology with Special Reference to the Near East"; Mr. Henry Field, of the Field Museum of Natural History, on "Ancient and Modern Inhabitants of Central Mesopotamia"; and Dr. W. M. Krogman, of Western Reserve University, on "Cranial Types of Alishar Huyuk." This meeting will be followed by a special inspection of the new Hall of the Races of Mankind and Hall of the Stone Ages of the Old World at the Field Museum of Natural History. On Friday evening the association will hold a general session on the subject of "Anthropology." The Saturday morning session will be devoted to physical anthropology. Professor C. U. A. Kappers will speak on "Racial Differences in the Human Brain"; Dr. T. Wingate Todd, of Western Reserve University, on "The Brain in Childhood"; Drs. W. H. F. Addison and Henry H. Donaldson, of the Wistar Institute of Biology, Philadelphia, on "The Area of the Sunken Cerebral Cortex as Determined from the Length and Depth of Selected Sulci, in Three Classes of Human Brains: Scholars, Hospital Whites, Hospital Negroes." Professor C. J. Herrick, of the University of Chicago, will lead a general discussion on "The Human Brain."

I—Psychology

- I-1. Section I of the Association. June 20-24.
Vice-president, Walter R. Miles; *Secretary*, John E. Anderson.

For Tuesday morning Section F has arranged a symposium on "Physical and Chemical Changes in Nerve during Activity," which the psychologists will find of interest. On Tuesday afternoon Section I will hold a symposium on "Character," in which will be presented a paper by Professor Emilio Mira, of Barcelona. Professor Mandel Sherman, of the University of Chicago, and several others will also participate. On Wednesday morning there will be a symposium on "New Conceptions of Intelligence." Professor Charles E. Spearman, of London, will speak on "New Conceptions and Test of Intelligence." Following the symposium, Professor Henri Pieron, of the Sorbonne, will give an address on "Sensorial Basis of Knowledge." On Thursday morning a symposium has been arranged on "Reaction Time," in which Professor Henri Pieron will speak. Professor Walter R. Miles, of Yale University, and several others will also participate. At the close of the symposium Professor Emilio Mira will give an address on "New Conceptions of Moral Behavior." For Friday morning a symposium is arranged on Gestalt, which will be discussed by Professor Wolfgang Koehler, of Berlin. Professor Raymond H. Wheeler, of the University of

Kansas, and several others will participate. It is hoped that a symposium on "Clinical Psychology" will be held on Saturday morning. On Saturday evening there will be a general session of the association, with an address by Professor Charles E. Spearman, on "Recent Advances in Our Knowledge of Human Personality."

K—Social and Economic Sciences

- K-1. Section K of the Association. June 27-30.
Vice-president, Wesley C. Mitchell; *Secretary*, James Ford.
- K-2. American Statistical Association. June 26-29.
President, Irving Fisher; *Secretary*, W. I. King.
- K-3. American Sociological Society. June 26-29.
President, L. L. Bernard; *Secretary*, L. Wirth.
- K-4. Econometric Society.
President, Irving Fisher; *Secretary*, Charles F. Roos.

On Tuesday evening, June 27, Section K has planned a program devoted to social insurance. Professor Wm. Oualid, of the University of Rome, and Professor G. A. Bagge, of the Social Science Institute of Sweden, will speak. On Wednesday morning, June 28, Section K and the Econometric Society are meeting in joint session with Section O on "Elasticity of Demand for Agricultural Products" (see announcement of Section O). A program of Section K on Wednesday evening will be centered around "Social Trends." The speakers will be Professor W. F. Ogburn and Professor Chas. E. Merriam, of the University of Chicago. On Wednesday or Thursday the Econometric Society will hold a meeting on "Recent Developments in Business Cycle Theory." Section K has arranged the program for the general session of the association on Thursday evening, with Professor Henry Clay as speaker. On Friday afternoon the Econometric Society will meet with the American Society for Testing Materials for a program on "Theoretical Economics in Engineering." Professor Irving Fisher, of Yale University, will preside. Dr. S. Karrer, of the Consolidated Gas, Electric Light and Power Company of Baltimore, will speak on "Economics in the Program of Industrial Research" with discussion by Dr. L. O. Grondahl, of the Union Switch and Signal Company; Dr. C. F. Roos, secretary of the Econometric Society, will speak on "Contributions of the Mathematician to Economics," with discussion by Professor H. Schultz, of the University of Chicago. Professor H. Hotelling, of Columbia University, will speak on "Contributions of the Theoretical Statistician to Economics," with discussion by Dr. R. W. Burgess, of the Western Electric Company. Dean Kimball, of Cornell University, will speak on "The Engineering Economist of the Future." On Friday evening the same societies will meet for a program

on "Some Fundamental Problems of Mutual Interest to Scientific Economists and Engineers." Dean A. A. Potter, of Purdue University, president of the American Society of Mechanical Engineers, will preside. Professor Jos. Schumpeter, of Harvard University, will give a discussion "From the View-point of the Scientific Economist"; Dr. F. B. Jewett, vice-president of the American Telephone and Telegraph Company, "From the View-point of the Engineer," and Dr. A. P. Fleming, of the Metropolitan Vickers Electrical Company, of Manchester, England, on "The Internationalization of Scientific Knowledge as a Factor in World Economic Recovery." The American Sociological Society and the Society for Social Research will hold round table discussions on the following subjects: "The Family," L. Guy Brown, of Ohio Wesleyan University, chairman; "Crime; The Community," R. D. McKenzie, chairman; "Prediction and Forecasting," S. A. Stouffer, of the University of Wisconsin, chairman; "Minimum Standards of Training in Research Techniques," W. C. Reckless, of Vanderbilt University, chairman; "Graphic Presentation," Howard W. Green, of the Cleveland Health Council, chairman; "Experimental Social Psychology"; "Collective Behavior in the Depression," Harold D. Lasswell, of the University of Chicago, chairman; "Rural Sociology." Each round table will meet one or two forenoons of the days from June 26 to 29.

L—Historical and Philological Sciences

- L-1. Section L of the Association. June 26.
Vice-president, Waldo G. Leland; *Secretary*, Joseph Mayer.
- L-2. The History of Science Society. June 26.
President, J. Playfair McMurrich; *Secretary*, F. E. Brasch.

On Monday evening, June 26, Section L has arranged a symposium on "Nationalism." Professor Charles A. Beard, president of the American Historical Association, will present a paper on "Nationalism in American History." Professor Bernadotte Schmitt, of the University of Chicago, will also speak. It is hoped that one or more of the foreign guests will take part.

M—Engineering

(From N. H. Heck and C. E. Davis)

The program of Section M is an integral part of a coordinated program of nearly a score of engineering societies meeting in Chicago during the week of June 26. Sessions of the engineering societies will start on Monday morning, June 26, and continue through Friday, Wednesday, however, being set aside for certain joint functions. The outstanding features of the week include a number of addresses by distinguished engi-

neers and scientists. On Tuesday afternoon at half past three Dr. Herbert J. Gough, of England, will present the Edgar Marburg Lecture under the auspices of the American Society for Testing Materials. Dr. Gough's subject has been selected as "Crystalline Structure in Relation to Failure of Metals, Especially by Fatigue." On Tuesday evening, June 27, under the auspices of Section M, Dr. A. P. M. Fleming, of England, will discuss "The Industrial Development of the Century." Outstanding engineers representing the various engineering societies will contribute to the discussion.

The joint functions of Wednesday will include the award of the Guggenheim Medal to Juan de la Cierva, inventor of the autogiro. The ceremony will take place at Soldiers Field, where Mr. Cierva will arrive in an autogiro and be conducted to the platform where the medal will be awarded. The rest of the day will be spent in a visit to the various engineering and scientific features of the exposition. In the evening there will be a joint dinner at the Stevens Hotel with an outstanding national figure as speaker.

On Thursday there will be a joint engineering luncheon under the auspices of the American Society of Military Engineers in honor of General Lytle Brown, chief of the Corps of Engineers. On Thursday evening a boat trip on the lake will give an excellent opportunity to enjoy the spectacular lighting effects of the exposition.

On Friday afternoon and evening there will be sessions under the auspices of the Econometric Society, participated in by the American Society of Mechanical Engineers, the American Institute of Electrical Engineers and the American Society for Testing Materials, which will be devoted to some fundamental problems of mutual interest to scientific economists and engineers. The speakers will be Dr. A. P. M. Fleming, of England, Dr. F. B. Jewett, Dean Dexter S. Kimball and others.

The Society for the Promotion of Engineering Education will celebrate its fortieth anniversary in the same general locale of its origin, in 1893, as the society was founded on the occasion of a previous fair. The program will be devoted largely to a résumé of the progress in engineering education during the life of the society.

Other features of interest include a joint dinner of the boards of direction of the four major engineering societies and a dinner of the National Council of State Boards of Engineering Examiners.

The engineering sessions are planned to cover the entire field of engineering. Approximately four hundred papers will be presented at some two hundred sessions during the week.

N—Medical Sciences

N-1. Section N of the Association. June 19-22.

Vice-president, C. R. Stockard; *Secretary*, Walter M. Simpson.

On Monday morning, June 19, Section N will meet in a joint session with Section C (see announcement of Section C). On Tuesday morning Section N will hold a joint meeting with Section F (see announcement of Section F). On Tuesday evening at eight o'clock a general session of the association is to be held under the auspices of Section N, commemorating "The Century of Progress in Medicine." On Wednesday morning, June 21, a symposium on "Pathological Physiology" will be held with the following speakers: Dr. Arthur L. Tatum, of the University of Wisconsin, on "Morphine Addiction and Morphine Tolerance"; Dr. C. H. Best, of the University of Toronto, on "Fatty Changes in the Liver of Normal and Diabetic Animals"; Dr. Maurice B. Strauss, of the Thorndike Memorial Laboratory, on "The Etiology of Pernicious Anemia and the Related Macrocytic Anemias"; Dr. William H. Park, of the Department of Health, New York City, on "BCG Vaccination." Madame Curie may also address this meeting. On Thursday morning, June 22, a surgical-endocrinological symposium will be held. Dr. George Crile, of the Cleveland Clinic, will give an address on "A Century of Progress in Surgery—Anesthesia, Antisepsis and Asepsis, Shock, and Careful Handling of Tissues." Dr. Max Ballin, of Detroit, will speak on "Clinical Recognition and Surgical Treatment of Parathyroidism"; Dr. Percival Bailey, of the University of Chicago, will discuss "Surgical Control of Hypophyseal Disorders"; Dr. John de J. Pemberton, of the Mayo Clinic, will speak on "Recent Developments in the Clinical Recognition and Surgical Management of Hyperfunction of the Thyroid Gland." Dr. Evarts Graham, of the Washington University School of Medicine, will speak on "Clinical Recognition and Surgical Treatment of Hypoglycemia Produced by Tumors of the Islets of Langerhans," with discussion by Professor Robert R. Bensley, of the University of Chicago.

O—Agriculture

O-1. Section O of the Association. June 20-28.

Vice-president, A. R. Mann; *Secretary*, P. E. Brown.

O-2. American Society of Agronomy. June 20-28.

President, P. E. Brown; *Secretary*, F. B. Smith.

On Tuesday morning Section O and the American Society of Agronomy will hold a joint session with Section G (see announcement of Section G). In the afternoon Section O and the American Society of

Agronomy, with Section G, will visit the greenhouses and laboratory of the University of Chicago. In the evening Section O and the American Society of Agronomy will attend the dinner for botanists and ecologists. On Wednesday and Thursday mornings Section O and the American Society of Agronomy will meet with Section G, the American Phytopathological Society and the American Society of Plant Physiologists for programs on progress in plant pathology during the century (see announcement of Section G). On Wednesday afternoon Section O and the American Society of Agronomy will meet in joint session with Section F and the American Society of Naturalists in a symposium on Heredity (see announcement of American Society of Naturalists). On Wednesday evening Section O will hold a dinner at which Sir Daniel Hall, of England, will speak on "Polyploidy and the Special Question in the Genus Tulipa," and Professor Jean Dufrénoy, of Brice, France, on "Death—The Change of Living Substance within the Cell." On Wednesday morning, June 28, Section O and the American Society of Agronomy will hold a joint session with Section K and the Econometric Society of America on "Elasticity of Demand for Agricultural Products," which will be discussed by Sir Daniel Hall, of England. It is hoped that Professor G. F. Warren, of Cornell University, Mr. Mordecai Ezekiel and Mr. E. J. Working, of the U. S. Department of Agriculture, will also speak.

Q—Education

- Q-1. Section Q of the Association. June 29-30.
Vice-president, Walter F. Dearborn; *Secretary*, William S. Gray.
- Q-2. National Society for the Study of Education. June 29-30.
President, M. E. Haggerty; *Secretary*, Guy M. Whipple.

Section Q will hold a joint meeting with the National Society for the Study of Education, the Department of Supervisors and Directors of Instruction and the American Educational Research

Association. On Thursday afternoon Section Q and affiliated societies will hold a session on "Recent Advances in the Study of Components of Mental Ability." Professor Frank N. Freeman will preside. Dr. Charles Spearman, of the University of London, will report on recent experiments in factor analysis. Dr. Karl Holzinger, of the University of Chicago, will discuss the general theory of factor analysis and Professor Louis L. Thurstone will lead the discussion. A program for Friday morning is being organized around "The Function, Value and Future of Educational Research." Professor Walter S. Monroe, of the University of Illinois, will preside. This will be discussed with reference to research activities (a) in public school systems, by Dr. W. W. Theisen, assistant superintendent of schools, Milwaukee, Wisconsin; (b) in colleges and universities, by Dr. V. A. C. Henmon, of the University of Wisconsin; (c) in departments of education, by Professor Edgar Blake, of Ohio State University. "Dependability and Value of Survey Types of Investigation" will be discussed by Dr. Harl Douglass, of the University of Minnesota. On Friday afternoon there will be a session on "Essentials of an Education," Professor Ernest Horn, presiding. The discussion will be introduced by papers on "Maturation and Its Relation to Instruction." Dr. Charles H. Judd, of the University of Chicago, will speak on "The Application of Maturation to School Organization and Teaching," and Professor C. R. Griffith, of the University of Illinois, will speak on "The Psychology of Maturation." The remainder of the program will consider the essentials of an education in contemporary life at (a) the elementary school level, by Miss Bess Goodykoontz, of the U. S. Office of Education; (b) the secondary school level, by Dr. A. K. Loomis, of the University of Chicago, and (c) the college level, by Vice-president Clarence S. Yoakum, of the University of Michigan. A program is being organized for Friday evening on "Education for a Democracy." Dr. Walter F. Dearborn will preside. Miss Jane Addams, of Hull House, and President Robert M. Hutchins, of the University of Chicago, will speak.

THE VALUE OF SCIENTIFIC RESEARCH TO AGRICULTURE¹

By Secretary HENRY A. WALLACE

U. S. DEPARTMENT OF AGRICULTURE

In this series of radio broadcasts it is the custom, as I understand it, for each Cabinet officer to do a little boasting about his own department. I am more than

¹ Address over a national radio network of the N.B.C. on May 1.

willing to do my share of that on behalf of the Department of Agriculture; but in my remarks to-night I hope not only to discuss the past of this department, but also to consider its future.

Necessarily, that involves the new farm bill. By

to-night I had hoped to be able to talk in some detail about it, but since the bill has not yet become law, detailed discussion will have to wait. In lieu of that, let me discuss the view that the new bill is the logical next step in the work of the Department of Agriculture in particular, and of all government in general.

In order properly to appraise the work of this far-flung department of the Federal Government, suppose we cut through a tedious underbrush of official and legal language, and set forth, in plain words, what the Department of Agriculture was established to do.

If you have thought about mankind's struggle through the ages to build an orderly society, you will agree that there have been two primary problems: first, to produce enough food and fiber to feed and clothe us all; second, to divide what we produce as equitably as possible.

We have always had to be concerned with production. Whatever else man can do without, he can not live without food. And that was no simple problem back in the days when men lived in tribes in the forests, and when the food supply depended upon a man's skill with crude weapons. When the first faint stirrings of commerce and industry drew men to live in larger groups in cities, the problem of a food supply became even more acute. Those who lived in the ancient cities could not grow their own food and fiber. Those who remained on the farm had the new job of growing enough not only for themselves, but for other families in nearby cities. Thus the dependence of the city dweller upon the farmer is overwhelmingly real. It is the key-log in this structure we call modern civilization.

And there were times when the structure was in danger of collapse, or indeed did collapse, because the key-log weakened and gave way. By reason of abnormal seasons, drought or flood, famines came and wrecked whole segments of human society. It was customary to blame those catastrophes on nature. Man, weak creature, was powerless if nature chose to starve him or drown him or otherwise maltreat him.

Somewhere back in the ages, a few individuals, more daring, more imaginative than the rest, began to wonder whether that was true. They reasoned that though nature could not be ignored, it could be modified. Man began doing that when he learned how to make fire by rubbing sticks together. We have been modifying the behavior of nature ever since, to prevent famine, flood and other disasters, until, as Julian Huxley puts it, man has done more in five thousand years to alter the biological aspect of the planet than nature has done in five million years. By putting nature in harness, so far as possible, we have solved mankind's first great problem—the prob-

lem of producing enough food to go round. We have solved it too well, as a matter of fact, but I shall speak of that later.

When it is possible for the farmers of a nation to increase production 50 per cent., while crop acreage is increasing only 25 per cent., we know that science has been at work. That is exactly what has happened in the United States during the past 30 years. In large part it is a result of the scientific work of the United States Department of Agriculture and the co-operating state institutions.

It was for the purpose of putting science to work in agriculture that this Federal Department of Agriculture was established by act of Congress 71 years ago. Washington, Jefferson and Franklin saw the need for it even back in their day. The department was created primarily for scientific research, its main job always has been a research job, and I hope research will always remain a principal duty.

Of course it is not enough to discover facts: a public institution has also the obligation to see that the facts are made available to all who can profit by them.

When a plant breeder in the department develops a variety of wheat that is highly resistant to rust, the job of the department has not ended with that discovery. The new variety has to be tried out in various regions, in the field. Next, the results of those trials have to be made known to wheat growers. That involves publications, both technical and popular, and articles for the press, and radio broadcasting. Then the seed of the new variety has to be made available to farmers. The county extension agent may step into the picture at this point, and suggest that the interested wheat grower sow some of the new seed in a test plot, alongside some of the seed he and his neighbors have been using in the past. And when the old and the new varieties of wheat are up and are harvested, let the neighbors for miles around come in to compare them, and decide whether or not the new variety is better than the old and worth investing in.

That is a thumbnail sketch of the way science is applied to agriculture in this country, and it portrays a system that is the envy of many another nation. Sir Horace Plunkett, Ireland's great authority on agriculture, in 1928 was moved to describe the Department of Agriculture as "the most widely useful department in the world." I am inclined to agree, and I only hope that its future will be as brilliantly successful as its past.

Whether he knows it or not, every farmer in the United States is farming differently to-day—and better—because of the scientific discoveries resulting from state and federal appropriations. The average hour of man labor and the average acre of land is undoubtedly 20 to 30 per cent. more productive to-day because of this scientific work. From the funda-

mental point of view—that of supplying the food and fiber needed by our modern civilization—the millions of dollars spent by state and federal agencies during the past generation have been abundantly worth while.

I appreciate that it is often difficult for the layman to see any earthly use in many of the things that scientists do and talk about doing. Of what value is it to you and to me, for instance, for a man to spend his time trying to discover the workings of nature? How can a man—we are inclined to say—do anything useful unless he works directly with the things that we all can touch and see, that we know have practical utility?

Well, when confronted by questions like that, I think of men like Faraday and Mendel and some of the scientists in the employ of the Federal Government. About a hundred years ago in England Michael Faraday was what we might call an experimental philosopher. He never concerned himself with the invention of machines. His sole aim was to learn something about the workings of nature. He discovered the principle of electromagnetic induction, and if you remember your high-school science, you will recall that without that discovery, we would today have no means of putting electrical energy to work for us. Without Faraday, the amazing inventions of Edison and Marconi would not have been possible, and your radio and your electric lights would not exist.

And Mendel, that cloistered Moravian monk who whiled away the hours studying plants and experimenting with the cross-breeding of varieties of garden peas—of what earthly use was all that? He did it because it interested him. But was it of any use to the rest of us? I can assure you that it was, for the principles he discovered have been employed by the plant breeders of to-day in developing more productive varieties of every plant that feeds and clothes you. Scientists like Mendel and Faraday were working in what we call pure science. They were trying to discover nature's fundamental secrets, but without thought of any practical application of their discoveries. Had some overzealous administrator tried to restrict their curiosity to some specific object, or the immediate solution of some highly practical problem, we would have been deprived, in all probability, of their great discoveries.

It falls upon another group of scientists to apply these basic principles to the pressing problems of the world and turn them to practical account. Thus most of the scientific research in government departments is applied science. The surprising thing, however, is that even in the field of applied science far-reaching discoveries are made, often as a by-product of the immediate task.

One of the most famous examples was the discovery by scientists in the Department of Agriculture some forty years ago, that a microorganism found in the blood of cattle is the cause of splenic fever, and that the disease is transmitted by the cattle tick.

During the years 1888 to 1893, four men spent most of their time trying to make that discovery. Splenic fever had become a costly disease of cattle throughout the South. Home-made remedies, treatment by skilled veterinarians, alike proved futile. The disease was costing the live-stock industry, and ultimately the consumer of meat, many millions of dollars.

The four Department of Agriculture scientists, in the employ of the government because they wanted to pursue scientific research without interruption, and at salaries sadly out of line with their worth to the nation—these men kept doggedly on the job despite all sorts of obstacles and disappointments. The joy of achievement was their chief reward. And their achievement proved to be of lasting benefit not only to the live-stock industry, but to all mankind, for their research was the first demonstration that a microbial disease can be transmitted exclusively by an insect host or carrier.

From that came the knowledge, at the hands of other scientists, that yellow fever, malaria, sleeping sickness and other maladies are similarly transmitted. From that flowed the successful control of yellow fever, for instance, which in turn made possible the building of the Panama Canal. So it can truthfully be said that the success of four Department of Agriculture scientists in discovering the cause of a cattle disease was a first step in the construction of the Panama Canal.

These scientists—by name Theobald Smith, Curtice, Kilgore and Salmon—of course had no idea of the far-reaching consequences of their discovery. They were intent on finding the cause of a cattle disease, not in discovering a fundamental principle in medicine. But that happens often in scientific research.

And at other times, a scientist may fail to solve one problem, only to solve another unexpectedly. Not long ago some chemists in the Department of Agriculture were examining molds—fungous growths, that is—to find one that would produce tartaric acid. Patiently they tested one after another, until they had exhausted the possibilities of 149 different molds. Finally the 150th rewarded their long search with success—but not the success they were expecting. Instead of producing tartaric acid, the 150th mold unexpectedly produced gluconic acid. This is now used in making calcium gluconate, the only calcium salt that can be injected between the muscles, without causing abscesses, in treating certain human diseases. This salt used to cost \$150 a pound. As a result of this research, it may now be had for 50 cents a pound.

Much of the scientific work of the department, however, calls for more than the ordinary equipment of a scientist. I am thinking of the plant explorers, the men who cut their way through treacherous jungles, or press on across the forbidding deserts of Mongolia in search of plants that we need here at home. Whenever you eat bread made from durum wheat, or enjoy a choice steak or pork chops from cattle or hogs fed on alfalfa and soybeans, or sample a package of dates or a crate of navel oranges from California or the new Satsuma oranges from Florida—whenever you enjoy any of these things, you are reaping the benefit of the work done by a handful of explorers employed by the Department of Agriculture.

If you live in the Gulf Coast region, you probably are familiar with the rise of a new industry down there, the growing of tung oil trees. About 25 years ago tung oil revolutionized the manufacture of varnish, but the oil had to be imported from China. Back in 1905 David Fairchild, plant explorer of the Department of Agriculture, brought the first seeds of the tung trees to the United States from the Yangtze Valley of China. Our plant industry men discovered, after a good deal of experimentation, that the trees do well in the Gulf Coast region, and the new industry is to-day firmly established there.

Not every trip of a plant explorer, of course, is so productive. Every trip has its dangers and its adventures, but frequently the results are slight. Yet the introduction of a navel orange or a useful variety of soybeans or a hardy wheat atones for many unsuccessful trips.

In one way or another, I have said, every farmer in the United States is farming differently to-day because of the scientific discoveries resulting from state and federal appropriations. To be specific and as up-to-date as possible, suppose we run down the list of research achievements reported by one bureau of the Department of Agriculture for the past year. Before me is a summarized report for the Bureau of Plant Industry, and among their accomplishments I find these items:

Established the superiority of five new hybrid lines of corn in Iowa tests; released, for the use of growers, two new lines of hybrid sweet corn that will be resistant to bacterial wilt; released, for the use of growers, a new wilt-resistant variety of tomato, known as the Pritchard; introduced a new blackberry variety, the Brainerd, especially adapted for the West and South, and also introduced three improved varieties of strawberry; developed new root-stocks for Satsuma oranges, and found new disease-resistant stocks for California grape vineyards; introduced a new sugar beet, U. S. No. 1, that is resistant to the costly curly-top disease, and that also greatly outyields older varieties; tested some promising new sugar-cane seed-

lings, crosses of American and New Guinea varieties; reported distinct progress in breeding alfalfa that will be immune to bacterial wilt; developed a new variety of Egyptian cotton in Arizona.

As another part of its job, this bureau investigates the storing, handling and processing of foods. For the year under report the bureau scientists discovered, among other things, that putting apples in cold storage immediately after picking almost completely prevents soft scald; that adding sulfur dioxide to the sawdust packing of grapes retards the development of mold; and that treating fruits with carbon dioxide before shipment is as effective as pre-cooling in preventing spoilage.

That is a partial report of the research accomplishments of one bureau. It gives point to the statement that research can stabilize crop production and eliminate or reduce those hazards—of disease, of climate, even of soil—which make agricultural production uncertain. For it remains true that though drouth or disease or insect pests may raise the price of a crop by reducing the supply, such higher prices are cold comfort to the particular farmer whose cotton has been destroyed by the boll weevil or whose wheat has been hit by rust. I have, I think, a proper scientific respect for insects and diseases, but I question whether we ought to leave it up to them to determine the size of our crops and the level of our incomes. Nor can I forget that every year, according to Dr. L. O. Howard, the damage wrought by insects nullifies the labor of a million men.

If time and your patience permitted, it would be possible to cite instances to show how research has affected all our major farm crops and classes of live stock, how the patience, the skill and the informed imagination of scientists employed by the Department of Agriculture have altered the agricultural map of this country and modified the farm practises of every farmer in the land. Many farmers are not aware of this, for the results of research reach the individual farm by an intricate, devious path, but they get there just the same.

If you will agree with me on that, I suspect you are at the same moment questioning whether this research has proved to be an unmixed blessing. For science and invention, you will say, have not only made it possible for us to produce enough to go around: they have made it possible for us to pile up towering surpluses, which in turn seem capable of bringing our whole economic system crashing down around our ears.

We can not deny that, when scientists in the Department of Agriculture develop a variety of wheat that produces five bushels more per acre than the variety commonly grown, one result may be, and often is, too much wheat. When our modern knowledge of

nutrition enables one bushel of corn to go as far as two bushels did in the pioneer days in feeding live stock, one result may be too much pork and lard.

Of late years the Department of Agriculture and the colleges have been aware of the problem. They have tried to meet it by helping the individual farmer adjust his own production to changing market needs. They have hoped that advice and complete information on supply and demand would suffice.

Where they have been remiss, in my judgment, is in declining to face the fact that the individual farmer can not adjust his production intelligently, unless he knows, with some degree of certainty, that his neighbors will do likewise. And it is to face that fact realistically that the new farm bill has been drafted. The essence of it is collective action, by all the producers, to accommodate their production to the market that actually exists.

Our expenditures for science, our efforts at increasing productive efficiency have in no sense been unwise. Certainly no thoughtful person could approve the abandonment of scientific research, or the relegation of our machines to the ash-heap. To do that would be like abandoning the use of automobiles because we have automobile accidents. As a rule, the fault is not with the automobile, but with the driver.

It is not the fault of science that we have unused piles of wheat on Nebraska farms and tragic breadlines in New York City at one and the same moment. Rather it is because we have refused to apply science to the development of social machinery, machinery that will regulate our economic system to the end that what we produce can be equitably divided.

I am not one to ask for less efficiency. I want more, and I know that we can get far more. But I want the efficiency to be controlled in such a way that it does more good than harm. I want to see the farmers of the South grow 300 pounds of cotton per acre instead of 150 pounds, and the farmers of the North 50 bushels of corn per acre instead of 35 bushels. I want to see the average milk cow yield 400 pounds of butter fat per year instead of 200. And I see no reason why our hogs eventually should not produce 100 pounds of pork on the average from 6 bushels of corn, instead of from 9 bushels.

These things can all be done. The research now going on will make it possible, and will pave the way for countless new agricultural achievements as well.

Only the other day I learned that research now in progress indicates that crops grown in some regions of the nation have a higher nutritional value than do apparently similar crops grown in other areas. If further study bears this out, the consequences will certainly be far-reaching. We may have a new agricultural map a decade from now.

The research job, far from being done, is only well

begun. We shall need new varieties of cereals and grasses to resist diseases better than those we now have. We shall have to keep cutting costs of production by increasing yields per acre. Methods of cultivation, like methods of feeding and managing live stock, must be subject to continuing investigation if we are to keep abreast of the continually changing economic world about us.

When our chemists, not long ago, discovered an economical method by which bagasse, a sugar cane waste, could be made into high-quality cellulose, suitable for rayon, we patted ourselves on the back for an achievement of considerable importance. But over in the Bureau of Chemistry and Soils is a small bottle of a brownish cellulose substance called lignin, which was derived from the corn plant after many years of experimentation. The chemist will tell you that lignin is one of the principal parts of woody plant tissues; that it can therefore be obtained in abundance; and that it may yield a startling new collection of products. Already he has discovered in lignin such compounds as phenol and creosol. Lignin may yet rank, in its rich potentialities, in its influence on disposing of farm wastes, with our major chemical discoveries.

No, the job of scientific research in agriculture is not over, nor will it ever be. But to-day we have a new job, a new field for experimenting—that of social control. Research to increase productive efficiency, to widen markets, must continue. Eliminate the less important research activities, in deference to the need for economy; get rid of the dead wood in our scientific organizations—but keep the men of science at the tasks which will always need doing. And add to the old job the one that has been begun so well, this new job of developing the machinery of social control.

Can we, do you suppose, become as efficient in our social experimenting as we have already proven ourselves in scientific experimenting? If this can be done, we can go ahead into one triumph after another in the scientific world. If it is not done, I fear for the future of our civilization.

The farm bill is an effort in the direction of such social inventiveness. In some ways, it is perhaps as crude as the first automobile. But I believe it is profoundly right in purpose, for it attempts a reconciliation between science and social justice; and I believe it can be made to work, if the rank and file of the people of the United States—the men who grow our food, the men who handle and distribute it, the men and women who consume it—the new machine will work if all these people are genuinely hungry to distribute the fruits of science in a just way.

For that is our great modern problem. Having conquered the fear of famine, with the aid of science, having been brought into an age of abundance, we now have to learn how to live with abundance. Some-

times I think it requires stronger characters, greater hearts and keener minds, to endure abundance than it takes to endure penury. Certainly it requires a new degree of tolerance among competing economic groups and a willingness to subordinate the will of the few to the welfare of the many.

Personally, I think the last twelve years have imprinted this lesson deeply on all of us. I think we are ready, now, to reach out towards a new order. I believe we are ready to attempt to plan our economic life in return for stability and security. If this is

true, then we have reached a great moment in the history of mankind. We have determined to become the masters rather than the victims of destiny. We are daring to bring the economic interests of men under conscious human control.

We may make mistakes along the way; we may have difficulty in mastering all the intricacies of an economic system that is full of puzzling contradictions; but if we operate our new social machinery with the spirit of social justice in all our hearts, I believe that it will work.

THE SIGNIFICANCE OF RECENT MEASUREMENTS OF COSMIC RAYS¹

By Professor ARTHUR H. COMPTON

UNIVERSITY OF CHICAGO

THREE major methods of observing cosmic rays have been developed. By means of an ionization chamber filled with a gas such as argon under high pressure the cosmic rays can be measured in terms of the conductivity or ionization they produce in the gas. Thus it is found that at high altitudes in a balloon or on a mountain a much greater ionization is observed than at sea-level, while inside a deep tunnel, if the gas is shielded from gamma-rays, ionization is almost completely absent. The cloud expansion chamber, invented by C. T. R. Wilson, makes visible the paths of the ionizing particles associated with the cosmic rays, as they break into ions some of the air molecules through which they pass. Some of these particles seem to be the cosmic rays themselves, whereas others are secondary particles produced by the cosmic rays. Highly sensitive ion chambers, connected through amplifying tubes to electrical recorders, serve to count the cosmic rays as they pass through the chambers. These are known as "counting tubes." By arranging these tubes in pairs, so connected that they will record only when both are excited simultaneously, it is possible to study the direction from which the cosmic rays are coming.

With the help of such devices it has been found that a kind of ray exists which comes from high above the earth and is strongly but not completely absorbed as it passes through the earth's atmosphere. Believing that these rays have originated in the remote parts of space, they have been called cosmic rays. The heat that they bring to the earth is less than that of starlight. But they are the most penetrating rays with which we are acquainted.

¹ Based on an address delivered at the dedication of the Eastman Research Laboratories of Physics and Chemistry, at the Massachusetts Institute of Technology, May 1, 1933.

Two types of theories have been suggested to account for the origin of these rays. The first type assumes the cosmic rays to be photons, or electromagnetic waves, like light or x-rays or the gamma-rays from radium, but of much shorter wave-length. If the rays are of this type, their observed penetrating power corresponds to the energy of rays that might be emitted by subatomic processes, such as the formation of hydrogen out of helium or the annihilation of hydrogen atoms. Dr. Robert A. Millikan has strongly defended the view that cosmic rays are emitted at the formation of heavy atomic nuclei from groups of lighter nuclei, and has made this a stage in the life cycle of matter in a continuous universe. Sir James Jeans has proposed the annihilation of hydrogen atoms as a source of the most penetrating cosmic rays, and sees this as one way in which the universe is running down.

The second class of theories supposes that cosmic rays are not photons, but electrically charged particles entering the earth's atmosphere from outer space. Dauvillier imagines that these particles are shot out from the sun by intense local electric fields. Swann suggests that they come from the changing magnetic field of sunspots on the hotter stars. But by far the most romantic and by no means the least plausible theory is that of Abbe Georges H. Lemaitre. He attributes them to a primeval explosion of the universe some thousands of millions of years ago, since which time the universe has been expanding, and certain atoms and pieces of atoms that have been flying about in space ever since constitute the cosmic rays which we now observe.

In order that a choice may be made among these theories, it is important that the nature of the cosmic rays be learned. Five methods of approaching this problem may be mentioned:

(1) Observations with the cloud expansion chamber described above show that the ionization observed in air is due directly to high-speed particles. When a strong magnet is present these particles curve in both directions, indicating that some are positively and some negatively charged. Some of these particles are certainly secondary rays produced by more energetic primary rays, though certain ones have energies sufficient to carry them through the earth's atmosphere. These experiments thus do not tell us whether the primary cosmic ray is a photon or an electrified particle.

(2) Experiments with the coincidence counters described above, performed by Bothe and K  lhorster in Germany and Rossi in Italy, have shown that these coincidences are due to ionizing particles which are absorbed at substantially the same rate as the cosmic rays themselves. These experiments have been supplemented by recent ones by Johnson and Street which show that the pairs of ionizing particles that are frequently observed are produced by rays which are themselves ionizing particles. Since the only ionizing particles with which we are acquainted are electrically charged, these experiments point strongly toward the cosmic rays as electrically charged particles rather than photons.

(3) Opposed to this conclusion are some early experiments by Millikan and his collaborators which seemed to show no variation of the intensity of the cosmic rays with the position in the earth's magnetic field. Theories, due to St  rmer and recently much more completely developed by Lemaitre and Manuel S. Vallarta at the Massachusetts Institute of Technology, have shown that unless they have energies much greater than is supposed, any electrified particles should have their paths bent by the earth's magnetic field, resulting in a diminished intensity near the equator as compared with that near the poles. During the past year a group of our associated expeditions have made measurements at stations widely distributed over the earth. Their combined data show precisely the kind of variation in intensity with latitude predicted by the theory, only the energy of the electrified particles is somewhat greater than had been supposed. More recent experiments by Clay and by Millikan's collaborators have confirmed this result. This indicates definitely that at least a part of the cosmic rays consists of electrified particles.

(4) At those latitudes where the deflection by the earth's magnetic field is sufficient to prevent part of the incoming electrified particles from reaching the earth, there should be a difference between the rays from the east and from the west. If the rays are positively charged, they should come mostly from the west; if negatively, mostly from the east. At these

latitudes, numerous experiments have failed to show any appreciable difference. Our geographical distribution curves, however, indicated that as far south as Mexico such differences should appear. Accordingly, Alvarez, from the University of Chicago, and Johnson, from the Bartol Research Foundation, have been working independently in Mexico City during the past month, and have both reported a definite predominance of the cosmic rays from the west. This means that at least a considerable part of the cosmic rays consists of positively charged particles.

(5) The recent high altitude balloon flights have had as their chief objective the study of the ionization due to cosmic rays near the surface of the atmosphere. It can be shown that if the primary rays are photons, the observed ionization should reach a maximum with increasing altitude, and then fall toward zero as the surface of the atmosphere is approached. If, however, the primary cosmic rays are electrified particles, the observed ionization should approach a maximum at the top of the atmosphere. The highest measurements so far performed are those of Regener, whose balloon went to 17 miles above the earth, and his results seem rather definitely to support the electrified particle theory.

Thus every type of direct test that has been devised has indicated the presence of electrified particles in the cosmic rays. We can say definitely that positively charged particles constitute an important part of these rays. The possibility has not been excluded that photons may be present among these rays as they enter the earth's atmosphere; but as yet no direct evidence of such photons has appeared, and it appears probable that, if present, they play a minor r  le.

The experiments thus favor those theories which are based upon the assumption of cosmic rays as electrified particles rather than as photons. Of the electrified particle theories, those which attribute the rays to particles shot from the sun or stars, as Dauvillier and Swann have done, are somewhat difficult to reconcile with the positively charged character of the rays. For while negatively charged thermoelectrons might well be thus produced, the origin of positively charged rays is more difficult to account for. New information on this point may be anticipated if work now in progress shows whether these positively charged cosmic rays are protons or positrons.

In the meantime, all the data so far found fit satisfactorily with Lemaitre's bold "explosion" theory of the rays.

A rapidly growing aspect of the study of cosmic rays is their use as a tool for the investigation of the structure of the atomic nucleus. The most striking result of such experiments is Anderson's recently an-

nounced discovery of the positive electron, or "positron." Because of the tremendous energy of the individual cosmic ray, it is capable of producing nuclear disruptions much more violent than those resulting from the most powerful artificial sources. Thus a recent photograph by Blackett shows no less than twenty pieces presumably ejected from the

nucleus of a single atom by the action of one cosmic ray. The energy of the particles flying from this burst is not less than several billion electron volts. It will be a long time before the laboratory will produce ten billion volt electrons. Until that time we may expect to find cosmic rays of unique value for studies of nuclear structure.

OBITUARY

WILLIAM HENRY HOLMES

WILLIAM HENRY HOLMES, anthropologist, geologist and artist, died April 20 at Royal Oak, Michigan, at the age of eighty-six years. Born near Cadiz, Ohio, on December 1, 1846, his parents Joseph and Mary Heberling Holmes, he received the schooling available in the forties, progressing till he graduated at the Hopedale Normal School. For several years he taught in the district and normal schools, until his preference for art prevailed over other interests.

Dr. Holmes entered into science by a fortuitous avenue which the ancients attributed to destiny or fortune. On a visit to Washington the youth was found in the Smithsonian Institution enjoying himself in drawing birds displayed in a case. One of the ornithologists happened by and saw the drawing, appreciated the evidences of his skill, and got him employment for work at the Institution. From that time on his pencil and brush were requisitioned for illustrations of the various reports. On that horizon Dr. Holmes viewed his future course in the development of his art. With this in view he later studied in Europe at several German schools. In the course of events he was drawn into the work of the U. S. Geological Survey and took the field in 1872 as artist under F. V. Hayden, becoming an assistant geologist in 1874. During this period he produced hundreds of drawings showing the physiographic features, of which those of the Grand Canyon of the Colorado are classics in geology. In charge of the survey of the San Juan region in Colorado, he stepped into a field that was to dominate his scientific life. This region, the homeland of the ancient Pueblo Indians, strewn with ruined pueblos and cliff dwellings, exerted its fascination to Dr. Holmes, and we find him in 1875 writing the first report on these archeological sites, his first contribution to anthropology. Many of these ruins he was the first white man to see, and he entered houses where the dust had not been disturbed for a millennium. Returning in 1889 to Washington he became connected with the Bureau of American Ethnology, pursuing researches on the geological history of man in America, of which subject he was the outstanding student. From 1894 to 1897 he was

non-resident and resident professor of anthropic geology in the University of Chicago and curator of anthropology in the Field Museum. During this period he prosecuted an archeological survey of the ruined Maya cities of Yucatan, the report demonstrating his skill as an artist, architect and archeologist. Again returning to Washington, he became head curator of the Department of Anthropology of the U. S. National Museum, and for a few years he devoted his efforts to museum science, building this branch of the museum to an enviable state of excellence.

As a master of museum science Dr. Holmes was without rival. In the harmonious arranging of cases for exhibit he applied the laws of structure implanted in him. To questions near to museums of the time he brought a consummate taste and unerring judgment as to ways and means. The group cases illustrating the races of man were designed by him as pictures telling the story in the most artistic manner. These groups show he had the knack to present science in an instructive and pleasing setting. For these reasons the groups are favorably and widely known as climaxes of achievement in museum installation. In a multitude of objects in the National Museum his taste and near approach to perfection are evident. Mention should be made of the models of ancient temples of Yucatan as examples of this outstanding artistic ability.

In anthropology the branch in which Mr. Holmes was especially proficient was archeology. To this nascent branch he contributed much of the groundwork which has remained unshaken to this day. To his early work in the Southwest he added explorations of ancient works broadly over the whole United States. It remained to him to correlate much of the data secured by personal fieldwork and the work of others. Confining his work to America, he took the leadership in controverting the application of European terminology and sequences to this field, advancing a restricted view as to the antiquity of man in the Western Hemisphere. In the era of sometimes bitter controversy that marked the adolescence of anthropology, Holmes was always to the front with well-reasoned contributions serving to clear up the subjects in question.

The body of anthropological literature contributed by Holmes in extent seems alone a life work. The larger works appeared in the annuals of the bureau. Among these are: *Stone Implements of the Potomac-Chesapeake Tidewater Province* (15th ann.); *Aboriginal Pottery of the Eastern United States* (20th ann.); *Handbook of American Antiquities. Part 1. Introduction.* (Bull. B. A. E. no. 60). During his administration of the Bureau the *Handbook of American Indians, Bulletin 30*, was brought to completion and published.

Throughout his career he displayed a remarkable ability to grasp a subject at once or to see the implications of a problem as unerringly as his pencil followed the subtle outlines of his model. The driving force that was within Holmes never ceased its urge

till near the close of his busy life. Whatever he undertook was carried forward under pressure of his indomitable will. This characteristic is observed in his youth when despite obstacles he trained himself in art.

Many honors came to Holmes during his busy life. He was a member of the National Academy of Sciences, president of the Washington Academy of Science and of the Cosmos Club. He was honorary member of the University of La Plata, Argentina, and prominent in Spanish-American conferences, meetings of the Americanists, and in many other movements. On his 70th birthday he was presented with a magnificent anniversary volume of anthropological essays by his friends and co-laborers.

WALTER HOUGH

SCIENTIFIC EVENTS

THE McDONALD OBSERVATORY

DR. OTTO STRUVE, director of the Yerkes Observatory of the University of Chicago, has announced that Mt. Locke, a 6,790 foot peak in the Davis Mountains in southwestern Texas, has been chosen as the site of the new McDonald Observatory.

The McDonald Observatory will be a cooperative enterprise on the part of the University of Texas, which is to build the telescope and observatory buildings from a part of the bequest of the late W. J. McDonald, of Paris, Texas, and the University of Chicago, which is to provide the staff for the observatory. The agreement between the two universities is the first cooperative effort in astronomy made in this country. Although enabling them to build a much larger and effective instrument than would have been possible had two independent observatories been constructed and staffed, the cooperative agreement will mean a saving of over a million dollars to the two universities.

The decision of Dr. Struve to place the McDonald Observatory on Mt. Locke was made following the return this week of an expedition headed by Professor George Van Biesbroeck, of the Yerkes Observatory. This expedition, which spent seventeen nights on Mt. Locke making observations, confirmed the findings of two earlier expeditions made by Assistant Professor Christian T. Elvey last November and by Dr. Struve in December.

A tract of 200 acres, which includes Mt. Locke, has been given the University of Texas for the observatory site. The Mt. Locke site is about fifteen miles from the nearest town, Fort Davis, and Dr. Struve believes that it offers the best conditions for astronomical research to be found in the United States.

Because the solar system is unsymmetrically situ-

ated among the stars of the galaxy, and more than nine tenths of the stars and nebulae interesting to astronomers are south of the equator, the farther south an observatory the better the conditions. Were unlimited means available, the McDonald Observatory probably would have been established south of the equator, in New Zealand.

The southern latitude of Mt. Locke, approximately 31 degrees, makes many stars visible which are never above the horizon at Yerkes Observatory at Williams Bay, Wisconsin. Atmospheric conditions are much better in the Davis Mountains also, the nights being uniformly clear and the stars being twice as bright as they are in the latitude of Chicago. The elevation of Mt. Locke exceeds that of the Mt. Wilson and Lick Observatories, and is just a little short of the elevation of Lowell Observatory near Flagstaff, Arizona, but the McDonald Observatory will have a much larger instrument.

Definite specifications for the equipment at the McDonald Observatory have been made and submitted to instrument builders in this country and abroad. Dr. Struve expects that the order for the telescope will be placed in the near future, and completion of the observatory may be possible a year ahead of the contract date of July 1, 1938.

The mounting of the McDonald telescope is to be constructed in such a way that the light of any star may be concentrated in a room of constant temperature, where it may be analyzed with the aid of prisms, photo-electric photometers or other analyzers. There will be a placeholder for the direct photography of comets, stars, planets and nebulae, and several specially designed lenses which will improve the optical definition of the instrument.

Second only in light-gathering power to the 100-

inch mirror at Mt. Wilson, the McDonald telescope will have an eighty-inch mirror made of glass with a low coefficient of expansion and will therefore be suitable to a climate where appreciable changes of temperature during one night are usual.

THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

THE British Association for the Advancement of Science will meet in Leicester from September 6 to 13. The inaugural general meeting will take place at 8:30 P. M. on Wednesday evening, September 6, when Sir Frederick Gowland Hopkins, also president of the Royal Society, will deliver the address of the president on the chemical aspects of life.

The presidents of the sections and the titles of their addresses are as follows:

Section of Mathematical and Physical Sciences, Sir Gilbert T. Walker, "Seasonal Weather and its Prediction"; Section of Chemistry, Professor R. Robinson, "Natural Coloring Matters and their Analogues"; Section of Geology, Professor W. G. Fearnside, "Structures of Some British Coal-fields"; Section of Zoology, Dr. J. Gray, "The Mechanical View of Life"; Section of Geography, The Right Honorable Lord Meston, subject to be announced; Section of Economic Science and Statistics, Professor J. H. Jones, "The Gold Standard"; Section of Engineering, R. W. Allen, "Some Experiences in Mechanical Engineering"; Section of Anthropology, the Right Honorable Lord Raglan, "What is Tradition?"; Section of Physiology, Professor E. D. Adrian, "The Activity of Nerve Cells"; Section of Psychology, Professor F. Aveling, "The Status of Psychology as an Empirical Science"; Section of Botany, Professor F. E. Lloyd, "The Various Door Mechanisms of *Utricularia* and *Polypompholyx* and their Method of Action"; Section of Educational Sciences, J. L. Holland, "The Development of a National Educational System"; Section of Agriculture, Dr. A. Lauder, "Chemistry and Agriculture."

There will be a large number of symposia and discussions.

Evening discourses to the members will be delivered on Friday, September 8, and Monday, September 11, by Sir Josiah Stamp, general treasurer of the association, on a subject in economic science, to be announced; and by Professor Jocelyn F. Thorpe, on "The Work of the Safety in Mines Research Board." A reception will be held by the Lord Mayor and Lady Mayoress of the City of Leicester (Councillor Arthur Hawkes, J.P., and Mrs. Hawkes), on Thursday evening, September 7; a garden party will be given by the University College on Monday afternoon, September 11; a reception will be given by the Leicester Literary and Philosophical Society in the Museum

and Art Gallery on Tuesday evening, September 12. The usual excursions to points of interest, to industrial establishments and to educational institutions have been arranged.

This is the second meeting of the association to be held at Leicester. It met there in 1907, when Sir David Gill, the astronomer, was president, and the occasion was notable as the last on which Lord Kelvin attended and addressed the association of which he had long been an active supporter. The meeting of the association in 1934 will be held in Aberdeen.

THE ROYAL INSTITUTION AND SIR WILLIAM BRAGG

WE learn from the London *Times* that at the annual meeting of the members of the Royal Institution, which was held on May 1, with the president, Lord Eustace Percy, in the chair, it was announced that the payments in connection with rebuilding had been completed. During the years 1929-32 the managers had been successful in collecting the sum of £96,300 for the rebuilding and research endowment.

The institution's Friday evening discourses and afternoon lectures had crowded the lecture theater on many occasions during the year, and the privilege of free attendance at afternoon lectures by *bona fide* students in London had been much appreciated and used. Professor G. Elliot Smith had succeeded Professor J. B. S. Haldane as Fullerian professor of physiology. On the research side the x-ray investigations under the direction of Sir William Bragg showed steady progress. Lord Eustace Percy was again elected president for the ensuing year, with Sir Robert Robertson treasurer and Major Charles E. S. Phillips secretary.

At the conclusion of the meeting a portrait of Sir William Bragg, the director, by William Nicholson was presented to the institution, where it is to be hung, by the honorary secretary, Major Phillips, on behalf of a group of friends. In a brief speech, as reported in the *Times*, Major Phillips paid a tribute to the artist and expressed the respect and admiration which the members of the Royal Institution felt for the great scientific achievements of their director and their appreciation of the manner in which he upheld its great traditions. All of them regarded him with affection, and it was fitting that his portrait should be hung on their walls with those of the other men who had made the Royal Institution what it was. He read a letter from Sir James Crichton-Browne apologizing for absence and remarking that the portrait showed "the face and figure of a real man, an embodiment of vital and intellectual vigour, a great discoverer, a brilliant expositor and a genial friend."

Lord Eustace Percy, accepting the gift on behalf

of the Royal Institution, said that the portrait was one which the institution might well be proud to possess; it reminded them very warmly and intimately of a man whom they all respected and loved.

Sir William Bragg said that he was proud and grateful that his portrait should be given with such expressions of good will. The institution was an unofficial body, not connected with any government or municipal establishment. It worked on its own and its successes had been due to the devotion of its members, who had always helped it within their powers. In the past 10 years he had always found a prompt response made by any member approached with a request on behalf of the Royal Institution for lectures or other services. He had never had an unfavorable response and hoped he never would. The institution was held in astonishing affection by the country at large. Its members were a friendly body, and in this lay their strength. They were trying to draw together, by personal contact if possible, all those interested in the advance of knowledge. That they had been able in the last three years to pull themselves out of difficulties and rebuild their home was the result of real friendship all around.

THE AMERICAN ACADEMY OF ARTS AND SCIENCES

At the annual meeting of the American Academy of Arts and Sciences held in Boston on May 10, the following officers were elected:

President, George H. Parker; *Vice-president for Class I*, Harry M. Goodwin; *Vice-president for Class II*, Walter B. Cannon; *Vice-president for Class III*, Edwin F. Gay; *Vice-president for Class IV*, Arthur S. Pease; *Corresponding Secretary*, Tenney L. Davis; *Recording Secretary*, Walter E. Clark; *Treasurer*, Ingersoll Bowditch; *Librarian*, Alfred C. Lane; *Editor*, Herbert V. Neal.

Fellows of the academy elected in the natural and exact sciences are:

CLASS I

Section 1—*Mathematics and Astronomy*

Jesse Douglas, Cambridge.

Marshall Harvey Stone, New Haven, Connecticut.

Section 3—*Chemistry*

Louis Frederick Fieser, Waltham.

George Bogdan Kistiakowsky, Cambridge.

Henry Weeden Underwood, Cambridge.

Section 4—*Technology and Engineering*

Harold Kilbrith Barrows, Winchester.

Arthur Edwin Norton, Cambridge.

Frank Edward Winsor, West Newton.

CLASS II

Section 1—*Geology and Meteorology*

Charles Franklin Brooks, Milton

Frank Morton Carpenter, Cambridge.

Section 3—*Zoology and Physiology*

Philip Bard, Cambridge

Alden Benjamin Dawson, Cambridge

Frank Rattray Lillie, Chicago, Illinois.

Jeffries Wyman, Jr., Chestnut Hill

Section 4—*Medicine and Surgery*

Reginald Fitz, Brookline

Edgar Erskine Hume, Washington, D. C.

George Burgess Magrath, Boston.

George Cheever Shattuck, Brookline.

Soma Weiss, Cambridge.

Among these elected in Class IV are:

Section 1—*Theology, Philosophy and Psychology*

Gordon Willard Allport, Cambridge.

Howard Crosby Warren, Princeton.

Frederic Lyman Wells, Newton Highlands.

Section 2—*History, Archeology and Anthropology*

Edward Sapir, New Haven

Foreign members were elected as follows:

Section of Chemistry

Jaroslav Heyrovsky, Prague.

Fritz Paneth, Königsberg.

Section of Zoology and Physiology

Hans Spemann, Freiburg i. B.

Section of Theology, Philosophy and Psychology

George Elias Müller, Göttingen.

Section of History, Archeology and Anthropology

Sir Arthur Keith, London.

SCIENTIFIC NOTES AND NEWS

THE Rumford Medal of the American Academy of Arts and Sciences has been awarded to Dr. Harlow Shapley, director of the Harvard College Observatory, for "researches on the luminosity of stars and galaxies."

PROFESSOR S. A. MITCHELL, director of the Leander McCormick Observatory of the University of Virginia, has been elected a foreign associate of the Royal Astronomical Society.

It is proposed to name a Colorado mountain peak after Dr. William Trelease, emeritus professor of botany of the University of Illinois, formerly head of the Henry Shaw School of Botany at Washington University, St. Louis, and director of the Missouri Botanical Garden.

PROFESSOR ALBERT EINSTEIN will deliver the first Gibson Memorial Lecture at the University of Glas-

gow on June 20. On June 21 the doctorate of laws will be conferred on him.

SIR CHARLES S. SHERRINGTON, Waynflete professor of physiology, University of Oxford, will deliver the Bede Lecture on May 24, on "Mechanism and the Brain."

THE Linacre Lecture was delivered at the University of Cambridge by Professor E. Mellanby on May 6 on "The Nervous System within the Pale of Nutrition."

PROFESSOR H. H. PLASKETT, who was associate and professor of astrophysics at Harvard University from 1928 until 1932, when he was elected to the Savilian professorship of astronomy at the University of Oxford, delivered his inaugural address on April 28 on "The Place of Observation in Astronomy."

THE Italian Eugenics Society recently elected Dr. Jon Alfred Mj  en, Vinderen Laboratorium, a corresponding member. Dr. Mj  en also recently was elected a corresponding member of the Berlin Society for Anthropology and Ethnology.

THE Daniel Guggenheim Medal "for notable achievement in the advancement of aeronautics" for 1933 has been awarded to Commander Jerome Clarke Hunsaker, vice-president of the Goodyear-Zeppelin Corporation of Akron, Ohio. The formal presentation of the medal will probably take place at a meeting of the Society of Automotive Engineers in Chicago in August. Previous Guggenheim medalists have included Orville Wright, Ludwig Prandtl, of Germany, Frederick William Lanchester and Juan de la Cierva of England.

THE Canadian Institute of Mining and Metallurgy has awarded the first platinum medal established for award by any scientific society to John James Denny, of Kingston, in recognition of his contribution to the art of concentrating gold and silver ores. The gift is that of the International Nickel Company of Canada, Limited, in commemoration of the fiftieth anniversary of the discovery of the nickel deposits in the Sudbury district. It was designed by Dr. R. Tait McKenzie, research professor of physical education at the University of Pennsylvania.

THE Colwyn Gold Medal of the British Institution of the Rubber Industry was presented on the occasion of the fourteenth annual dinner, held in London on April 28, to W. H. Paull in recognition of his services to the pneumatic tire industry.

FOUR appointments have been made by Yale University and the Bernice Pauahi Bishop Museum of Hawaii, in their joint program of scientific investigation within the Pacific Ocean area. Dr. Peter H.

Buck has been reappointed Bishop Museum professor of anthropology at Yale, and Professor Samuel J. Record, of the Yale School of Forestry, has been selected as the representative of the university to go to Honolulu to consult with the director and trustees of the museum in regard to further collaboration between the two institutions. Arthur C. Smith, associate curator of the New York Botanical Garden, and Laura M. Thompson, of Berkeley, California, have been appointed Bishop Museum research fellows for 1933-34.

DR. C. L. BUTLER, who has been a member of Mellon Institute since 1926, has been appointed senior fellow in pure research in the department of research in pure chemistry.

DR. GEORGE B. RAY, associate professor of physiology in the School of Medicine of Western Reserve University, has been appointed professor of physiology and pharmacology at the Long Island College of Medicine. He succeeds Dr. John C. Cardwell, who retired last June.

CAROL Y. MASON has been appointed assistant professor of geology at Milwaukee-Downer College.

DR. K. G. EMEL  US, lecturer in physics at the University of Belfast, who is at present in the United States as holder of a Rockefeller fellowship, has been appointed to the chair of experimental physics in succession to Professor W. B. Morton.

THE Committee on Scientific Research of the American Medical Association has made a grant to Dr. Robert Hegner, professor of protozoology in the Johns Hopkins School of Hygiene and Public Health, for the purpose of studying the relation of starch to infections with intestinal protozoa.

PROFESSORS C. J. JOUBERT and M. S. du Toit, of Stellenbosch University in the Union of South Africa, arrived recently at the Citrus Experiment Station of the University of California, at Riverside, and are making an extended study and research in connection with agricultural problems affecting South Africa. Professor Joubert is making a study of the methods of biological control of insect pests, especially in connection with California's control of the mealy bug situation. Professor du Toit is studying methods of reclamation of alkali lands.

DR. KURT LEWIN, acting professor of psychology at Stanford University, sailed recently for Japan. He will travel through Japan and Russia, lecturing at the universities of Tokyo and Moscow. He planned to arrive early in May in Germany, where he will continue his work. Professor Lewin was formerly connected with the Institute of Psychology at the University of Berlin.

DR. THOMAS BARBOUR, professor of zoology and director of the University Museum at Harvard University, made the principal address at the public opening of Maryland Hall, University of Richmond, on April 28. Maryland Hall completes the group of science buildings at that university.

PROFESSOR CHARLES E. SPEARMAN, of the University of London, lectured before the Society of the Sigma Xi at Northwestern University on May 5, on "Current Psychologies."

At a joint meeting at Washington University of the Academy of Science of St. Louis and the St. Louis Anthropological Society on April 26, Dr. Albert Ernest Jenks, professor of anthropology at the University of Minnesota, delivered an illustrated address on "Minnesota's Glacial-Age Man."

PROFESSOR ELIOT R. CLARK, of the University of Pennsylvania, delivered an address to the faculty and students of the School of Medicine, George Washington University, on April 29, on "The Spontaneous Activity of Capillaries."

DR. L. A. WOLFANGER, of Columbia University, recently gave a series of lectures at Northwestern University on the characteristics, interpretation and economic significance of soils.

DR. JAMES EWING, Cornell University Medical College, and director of the Memorial Hospital, New York, will deliver the second Frank Billings Lecture of the Thomas Lewis Gilmer Foundation of the Institute of Medicine of Chicago, on May 26. His subject will be "The Depression: Its Effects on Medicine, Research and Practice."

At the suggestion of Dr. Max Henius, of Chicago, the Danish Government has appointed a committee of the most distinguished scientific men in Denmark to plan and prepare for the Museum of Science and Industry of Chicago a comprehensive series of exhibits to show the evolution of Danish science from the days of Tycho Brahe. The chairman of the committee is Frederik V. Petersen, under-secretary of state, and the vice-chairman is the Danish Ambassador to the United States, Otto Wadsted. Other members include Professor Niels Bohr; Benny Dessau; Dr. Martin Knudsen, professor of physics in the University of Copenhagen; Dr. August Krogh, professor of physiology in the University of Copenhagen; Dr. Svend Lomholt, director of the Finsen Laboratories; Dr. T. Madsen, director of the State Serum Institute; P. M. Michelsen, chairman of the Danish Arts and Crafts Society; Professor A. W. Moerkeberg, director of the Royal Danish Agricultural College; Professor N. E. Noerlund, president of the Royal Danish Science Association; Director Charles H. Olesen,

chairman of the Society for the Development of Danish Industries; Professor Valdemar Poulsen, inventor of the radio telephone and other radio devices; Professor S. P. L. Soerensen, director of the Carlsberg Laboratory, and Dr. E. Buch Andersen, professor of physics in Aarhus University.

FORMAL installation of a new chapter of Sigma Xi was made on April 25, in the University of California at Los Angeles. Fifty charter members, principally faculty and teaching assistants, make up the initial roster of the new chapter. Following the official dinner held in Kerekhoff Hall, the charter members and many prominent guests from outside institutions listened to the formal addresses of the delegates charged with the installation. Professor Chas. J. Chamberlain, of the University of Chicago, and Dr. J. A. Anderson, astronomer and president of the Mt. Wilson-California Institute Chapter, officiated. Officers elected included Dr. Samuel J. Barnett, chairman; Dr. E. K. Soper, secretary, and Dr. Hosmer W. Stone, treasurer. Pending establishment of the long-delayed graduate school in the Los Angeles division of the state university, membership in Sigma Xi will be confined largely to the university staff. Political developments in state legislative circles, however, are said to promise an early recognition of graduate study on the southern campus.

THE tenth annual initiation meeting of the University of Virginia Chapter of Sigma Xi was held on May 2. The meeting was addressed by President Joseph S. Ames, of the Johns Hopkins University, who spoke on "Recent Applications of Science in Aviation." The ninth annual award of the President and Visitors' Research Prize of \$100 was made to Dr. Carl C. Speidel, of the school of anatomy, Department of Medicine, for a paper entitled, "Studies of Living Nerves; the Movements of Individual Sheath Cells and Nerve Sprouts Correlated with the Process of Myelin-sheath Formation in Amphibian Larvae." The Andrew J. Fleming Prize of \$50 for the best paper in biology by a graduate student was awarded to Mr. Chauncey McL. Gilbert.

THE fourth annual New York State Public Reforestation Conference was held on May 12 and 13 in Binghamton, N. Y., under the auspices of the New York State College of Forestry at Syracuse and the Binghamton Chamber of Commerce. Among the speakers on the program were Lithgow Osborne, Conservation Commissioner, Albany, New York; Seth Gordon, president, American Game Association, Washington, D. C.; Congressman John D. Clark, co-author of the Clark-McNary act, an important forestry measure; Dean Samuel N. Spring, of the New York State College of Forestry, and William G.

Howard, director of the Department of Lands and Forests in New York.

THE Mexican Society of Geography and Statistics recently celebrated its hundredth anniversary with special ceremonies, attended by President Rodriguez, cabinet ministers and members of the diplomatic corps. The celebration, which consisted of two addresses and several orchestra numbers, marked the centenary of the issuance of a decree by President Valentin Gomez Farias in 1833, establishing the "National Institute of Geography," an organization which later became the Mexican Society of Geography and Statistics.

THE annual meeting of the British Medical Association will be held for the first time in Dublin next summer under the presidency of Dr. T. G. Moorhead, Regius professor of physic in Trinity College. The annual representative meeting will begin on July 21 and will be continued on the following three week days in the Hall of the Royal Dublin Society, where Professor Moorhead will deliver his presidential address on July 25. The clinical and scientific work is being divided among sixteen sections, which meet on the mornings of Wednesday, Thursday and Friday in Trinity College and University College.

THE fourth International Congress of Radiology will be held in Zurich, under the presidency of Professor H. R. Schinz, from July 24 to 31, 1934. Membership of the congress is confined to members of radiological societies and those introduced by such societies. The thirty-two countries which were represented at the third congress in Paris have been invited by the organizing committee to appoint delegates to the international committee and to nominate a speaker to report on the organization of the cancer campaign in his country at the opening session. At the general meetings the following subjects will be treated: x-ray diagnosis of bone tumors, vasography, the development of pulmonary tuberculosis as seen radiologically, radiation treatment of uterus-carcinoma, radiation treatment of malignant tumors of the mouth and pharynx, radiation genetics, mitogenetic radiation (mitogenetische strahlung), structure analysis, identical physical measurement of the dose in x-ray and radium treatment, hard gamma-rays, cosmic radiation, earth-radiation, shortwave therapy (kurzwellentherapie). In addition the sections for x-ray diagnosis, radiotherapy, radiobiology, radiophysics and technic, electrolgy and heliotherapy will hold discussions and every member of the congress is entitled to present a communication. During the congress an exhibition of apparatus, photographic accessories, chemical products and scientific books will be on view. All radiological societies are requested to send as soon as possible a list of their members to the

general secretary, Dr. H. E. Walther, Gloriastrasse 14, Zurich.

THE award of five Stratheona Fellowships for the investigation of transportation problems has been announced by Yale University. All five men have had previous railroad experience, two of them being third generation railroad men. The recipients of the fellowships are: Robert A. Emerson, Morden, Manitoba; Stevenson Milne Gossage, Montreal; Thomas M. C. Martin, Warsaw, Wisconsin; Palmer E. Savage, Montreal, and Lyell R. Shellenbarger, Hopkins, Minnesota. The Stratheona fellowships were made possible by the bequest of Lord Stratheona, born Donald Alexander Smith, who came to Canada with the Hudson Bay Company and who is identified with the pioneer days of the railroad on this continent. He served in the Dominion House of Commons, became High Commissioner of Canada in 1896, and was raised to the peerage in 1897. In addition to the fellowships, Lord Stratheona's will provided for two professorships at Yale devoted to the study of transportation, and for the erection of Stratheona Hall with its collocation of offices, classrooms and a special working library for students and instructors making transportation their major interest. The Stratheona professorship of mechanical engineering is held by Professor Samuel W. Dudley, and the Stratheona professorship of engineering mechanics, by Professor Charles J. Tilden.

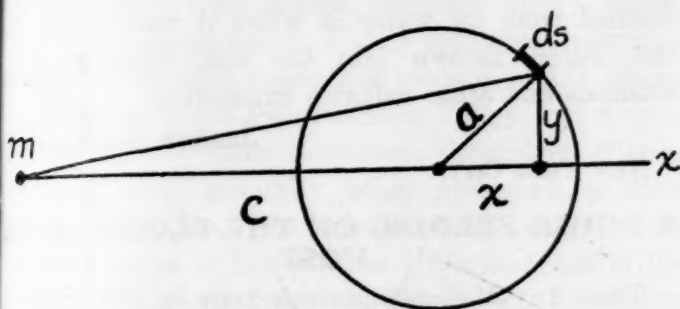
THE first specimens to be received of the new radium and silver ores of Great Bear Lake, Canada, by the Academy of Natural Sciences of Philadelphia, have been placed on exhibition. This discovery of pitchblende, the principal ore of radium, was made on the eastern shores of Great Bear Lake, just below the Arctic Circle, by Gilbert LaBine in 1930. Associated with the pitchblende was much silver. The glaciated surface of one vein of silver was so wide as to rival the famous "silver pavement" of Cobalt, Ontario. So remote is the district that airplanes are the chief method of reaching it and it then is accessible only during a few months of the year. Several tons of pitchblende already have been produced, and are being reduced to radium at a plant just erected at Port Hope on Lake Ontario. A new and efficient process has been developed by the Canadian Bureau of Mines, which greatly cuts down the time needed to recover the radium. Supplementing the exhibit are a large mass of silver from the Eldorado Gold Mines, at LaBine Point, Great Bear Lake; gold from Nova Scotia; labradorite from Labrador; asbestos from Quebec; fluorite from Ontario; and specimens of blue sodalite and nickel ore obtained on a recent expedition to Canada by the Academy of Natural Sciences.

DISCUSSION

THE ATTRACTION OF A SPHERE

It is surprising to find in *SCIENCE* for April 14, 1933 (page 371), a denial of the well-established theorem that under the Newtonian law of gravitation the attraction between two homogeneous spheres is the same as if the entire mass of each were concentrated at its center. Since the proof of this theorem, while entirely elementary, is often omitted in the text-books, it may be permitted to reproduce it here.

Consider a thin spherical shell of radius a and surface density ρ , attracting a particle of mass m at distance c from the center. If the surface is regarded as generated by rotating a circle about the axis of x , as shown in the diagram, an element of arc ds , rotating through a small angle $d\theta$, will generate an element



of area $y d\theta ds$, which may be regarded as a particle whose mass is $\rho y d\theta ds$.

According to the Newtonian law, the force exerted by this element on the particle m is $G [m \rho y d\theta ds] / [(c+x)^2 + y^2]$. This force is directed toward the element, and the component along the x -axis (which is all that concerns us) is obtained by multiplying by the cosine of the angle, namely, $(c+x) / [(c+x)^2 + y^2]^{\frac{1}{2}}$. Hence, noting that $y ds = a dx$, and $y^2 = a^2 - x^2$, the element of force along the x -axis is

$$(c+x) [G m \rho a d\theta dx] / [c^2 + 2cx + a^2]^{\frac{3}{2}}.$$

Integrating from $\theta = 0$ to $\theta = 2\pi$, and then from $x = -a$ to $x = a$, we have as the total force acting on the particle m along the x -axis,

$$F = \int_{-a}^a \frac{(c+x) G m \rho 2\pi a dx}{[c^2 + 2cx + a^2]^{\frac{3}{2}}} \quad (1)$$

Now suppose that the mass of the attracting spherical surface, namely $4\pi a^2 \rho$, were concentrated at a distance D from the particle m , where D is as yet undetermined. Then, by the Newtonian law, the force acting on the particle m would be

$$F' = Gm (4\pi a^2 \rho) / D^2$$

Equating these values of F and F' , we have the following equation for determining D :

$$\frac{2a^2}{D^2} = \int_{-a}^a \frac{(c+x) a dx}{[c^2 + 2cx + a^2]^{\frac{3}{2}}} \quad (2)$$

To evaluate this integral, make the substitution $t = (c^2 + 2cx + a^2)^{\frac{1}{2}}$, and note that when $x = a$, $t = c + a$, and when $x = -a$, $t = |c - a|$, where the vertical bars indicate the absolute value of $c - a$. Then we find

$$\frac{2a^2}{D^2} = \frac{a}{2c^2} \int_{|c-a|}^{c+a} \left(1 + \frac{c^2 - a^2}{t^2}\right) dt. \quad (3)$$

Two cases must now be distinguished, according as the particle m is outside or inside the spherical shell.

Case 1. If $c > a$, $|c - a| = c - a$, and we readily find $2a^2/D^2 = (a/2c^2) (4a)$, so that $D = c$.

That is, the attraction of the spherical shell at an external point is exactly the same as if all its mass were concentrated at its center.

Case 2. If $c < a$, $|c - a| = a - c$, and we find $2a^2/D^2 = 0$, so that D is infinite. That is, the attraction of the shell at an interior point is zero.

Finally, a solid sphere in which the density at any point is a function only of the distance of that point from the center, may be regarded as made up of a series of concentric homogeneous shells. Since each shell attracts an external particle as if all its mass were concentrated at its center, the same will be true of the sum of the shells. Hence we have the theorem:

On the basis of the Newtonian law of the inverse square, a homogeneous sphere, or any sphere in which the density is a function only of the distance from the center, attracts an external particle exactly as if all the mass of the sphere were concentrated at its center.

In view of the recent misunderstanding of this theorem, I trust that this reproduction of the standard proof may not be wholly superfluous.

EDWARD V. HUNTINGTON

HARVARD UNIVERSITY

APRIL 18, 1933

THE MOVEMENT OF DIFFUSIBLE SUBSTANCES IN FOOD PRODUCTS

WHEN fluids diffuse through substances of capillary structure, they tend to carry solutes with them. Where water is the diffusing fluid, phenomena of hydrolysis, chemical reaction, selective adsorption and differential diffusion may become manifest.¹ Colloids may diffuse, albeit more slowly than crystalloids—a

¹ Jerome Alexander, *Jour. Am. Chem. Soc.*, 39: 84, 1917; *SCIENCE*, 54: 74, 1921.

fact explicitly stated by Thomas Graham, but often garbled or misstated.

Where evaporation can take place at the exterior surfaces of the mass through which diffusion is occurring, there is a marked tendency for non-volatile solutes to accumulate at such surfaces.² Some possible consequences of this movement of diffusible substances in agricultural operations have been pointed out, for plant food is carried with diffusion streams.³

Since many of the operations whereby foods are prepared for consumption involve the evaporation of water from exposed surfaces (e.g., the baking of bread, ripening of fruits), it is obvious that various solutes may be separated or segregated to a greater or lesser extent in the process. This led me to include in a paper written several years ago, but still unpublished, a few remarks on "Skins and Crusts," epitomized below.

In discussing with Mr. Robert Whympers a paper he is about to read before a joint meeting of several chemical societies in New York (April 14), it developed that his experimental results dealing with the processing of cacao beans, illustrated this principle of diffusion. We therefore decided to entitle the paper: "The Movement of Diffusible Substances in Food Products. I. Preparation of Cacao," with the expectation that it will be the first of a series of papers dealing with this aspect of food and their preparation.

Apart from the question of economy, skins and crusts are commonly reputed to be "healthy." Children and adults are often urged to eat the skins of baked potatoes, for example. So far as I know, there have been no precise determinations as to what extent salts, vitamins and other diffusible substances accumulate in or near the surface layers of bread, potatoes, and the like; but it seems extremely likely that cooking would result in some marked degree segregation of solutes, which would tend to persist for some time after the cessation of active surface evaporation.

Bechhold showed that plaster of Paris "bricks," soaked in copper sulfate solution and then dried, had practically all the copper salt at or near their exposed surfaces, although when wet they were blue clear through. The slow accumulation of salts at the exposed surfaces of ordinary building bricks is known to every one, for it so often constitutes an eyesore. Mr. Whympers has called my attention to the fact that genuine mummy wheat from Egyptian tombs contains on the average only about 0.7 per cent. of salts, whereas the usual average for wheat to-

day is about 2 per cent. Some old samples from Rothamsted Experimental Station (Harpenden, Herts., England) showed the following:

Sample of wheat dating from 1852	0.90 % salts
" " " " " 1853	0.83 % "
" " " " " 1854	1.14 % "

Presumably, as moisture is absorbed and given up by the wheat kernel, there is a slow accumulation of salts on the exterior, and much of this extruded salt falls or is rubbed off, thus decreasing the content remaining in the grain itself.⁴

A study must be made of many of the common practises of the kitchen, which are generally based on sound scientific foundations, even though this be unknown to cooks or to scientists. Vegetable soups (*minestra*), and "pot likker" (popular in the South), contain valuable solutes, and braised or steamed vegetable would seem to be more desirable than vegetable drained from the water in which it was boiled; for this water, thrown into the sink, contains salts, vitamins and other valuable extractives.

JEROME ALEXANDER

NEW YORK CITY

A LOUSE FEEDING ON THE BLOOD OF ITS HOST

THAT any Mallophagan can actively remove blood from its host and thus warrant consideration as a possible vector or intermediate host of organisms causing avian disease has been extensively denied.

This writer, while recently studying poultry lice at Cornell University, observed individuals of *Menopon stramineum* Nitzsch running about on the skin of a white fowl and showing a pigmented substance in the crop, indicative of blood. That this was not obtained from clots from accidental injuries to the host was strongly suggested by the finding of an individual, showing blood in the alimentary tract, with mandibles deeply sunken in the quill of a young feather from which the dermal papilla, bearing blood vessels, had not yet withdrawn. On the removal of the louse blood flowed from the wound. The injury appeared as if two holes, one for each mandible, had been pierced in the quill and then the partition separating them cut out. Examination of the quill showed many scars of the same type of wound as the one from which the louse had been removed. The unfolding barbs showed still older scars, suggesting that this type of feeding was habitual. The louse and feather were removed and preserved.

Similar observations by others working with poultry lice are awaited with interest.

F. H. WILSON

TULANE UNIVERSITY

⁴ R. Whympers, "Knowledge," 36: 85-138, 1913.

² H. Bechhold, *Kolloid Zeitschrift*, 27: 299, 1920; W. Kraus, *ibid.*, 28: 161, 1921.

³ Jerome Alexander, *SCIENCE*, *loc. cit.*, and 56: 196, 1922.

HAIL PRINTS AND MUD-CRACKS OF PROTEROZOIC AGE

ON page 679 of the second part (1932) of his "Treatise on Sedimentation," Professor W. H. Twenhofel calls attention to the fact that geologists have neglected to record hail prints in rocks more ancient than the Triassic.

Apparent hail prints, with deep pits and elevations opposite the side of impact, occur in the Proterozoic Beltian rocks of Glacier National Park. They are commonest in the basal (Rising Wolf) and uppermost (Rising Bull) members of the Grinnell formation, in the Bighorn Basin of the Two Medicine Valley, and at the western foot of Gunsight Pass. They also occur in Hole-in-the-Wall and Kintla quartzites in the Boulder Pass district, in the north-western part of the park.

Twenhofel also remarks (page 686) that the commonly assumed three cracks, radiating from a center, seem to be the exception among mud-crack patterns. They are; but such cracks are common in the Rising Bull member in the Two Medicine Valley, and appear in other shallow water formations throughout Glacier National Park, generally being preserved as sand fillings in argillite. We have observed similar cracks in sandy shales of late Medina (Silurian) age in the Niagara Gorge near Lewiston, New York. Specimens are in the collections of the Buffalo Museum of Science.

CARROLL LANE FENTON
MILDRED ADAMS FENTON

WEST LIBERTY, IOWA

THE NEED OF OPPORTUNITY FOR EXCEPTIONAL ABILITY

PROFESSOR L. W. STERN, of the University of Hamburg, president of the German Psychological Association; Professor Gustav Kafka, of the Dresden Institute of Technology, secretary, and Professor David Katz, of the University of Rostock, member of the council, have been compelled by their colleagues to resign offices which indicate the high standing of Jews in the intellectual life of Germany. Professor Felix Krueger, the successor of Wilhelm Wundt at Leipzig, has been elected president of the association, and the place of meeting has been changed from Dresden to Leipzig.

Shortly after the conclusion of the war I wrote to Professor Krueger proposing that the International Congress of Psychology meet in America to mark the friendly relations of the psychologists of the world.¹

¹ It should be put on record that at a meeting held in Philadelphia in August, 1917, of the Psychology Committee of the National Research Council (which accomplished such useful service for the government during the war) I proposed the following resolution which, as I remember it, was unanimously approved:

but he opposed the plan. The congress was in fact held at Oxford in 1923, it having been the first international congress after the war (though the physiologists met the same summer); Professor Krueger advised German psychologists not to attend. He did not go to the congress held in Copenhagen last summer and refused to invite the next congress to meet at Leipzig; as Professor Köhler did not want us at Berlin, an invitation from Madrid was accepted.

The announcement to members of the German Psychological Association of the meeting to be held in Leipzig in October, signed by Professor Krueger, is more nearly what might be expected in Soviet Russia or in Italy than in Germany. Its rhetoric is not easy to translate, so I quote:

Die Erinnerung an Wilhelm Wundt, den Hundertjährigen, paart sich hierbei mit der Zuversicht, das die deutsche Psychologie in lebensvollem Zusammenhange mit ihrer ruhmreichen Vergangenheit stetig und entschieden vorwärts schreiten wird. An alle Mitglieder richtet der Vorstand die Bitte, sich dahin zu vereinigen, das die Leipziger Tagung einen Verlauf nehme, wie ihn die Würde der Wissenschaft und die hohen Aufgaben unserer Gesellschaft erfordern. Aus den Umwälzungen der gegenwärtigen Zeit soll die *Deutsche Gesellschaft für Psychologie*, durch Gemeinschaftskräfte innerlich verbunden, neu gefestigt hervorgehen.

Die bisher vorgesehenen Sammelreferate bleiben in Kraft. Etwaige Änderungen oder Ergänzungen des übrigen Programms sollen vornehmlich die Richtung auf Fragen der *Persönlichkeitsforschung* nehmen. Zugleich soll die *praktische* Bedeutung der Psychologie für Kernfragen des gegenwärtigen deutschen Lebens gebührend zu ihrem Rechte kommen.

It will be noted that stress is laid on work on the problems of individual differences and on the practical applications of psychology in the service of the new political and social developments in Germany. It is a curious circumstance that I made in Leipzig now nearly fifty years ago the first measurements of individual differences and carried out the first quantitative work in applied psychology. Wundt was so much opposed to these experiments that I could not continue them in his laboratory, but was compelled to purchase the needed apparatus and set it up in my own rooms. As late as 1921 when I wrote to

Whereas, the President of the United States has stated that there is no quarrel and should be no ill-feeling between the people of the United States and the people of Germany;

Resolved, that the Psychology Committee of the National Research Council places on record its appreciation of the wisdom of the President's expression of good-will. We recognize our obligations to the German universities and to the great men who have led in the development of psychology. We trust that an early peace may be established and that we may soon again be able to cooperate with German and Austrian psychologists in the advancement and in the useful applications of our science.

Professor Krueger in regard to the Psychological Corporation, which we were establishing to advance the applications of psychology and to place research on an economic basis, he objected emphatically to such uses of psychology.

It should, however, be realized that we are not in a position to cast the first stone at our German colleagues. Communists are as anathema here as there. Jews are not treated on terms of equality, either as teachers or as students, in our eastern universities. The president of the largest of them is said to have given the instruction: "Do not exclude any student because he is a Jew, but do not admit any Jew if it can be helped." Twenty years ago I was compelled to resign from the Century Club because I had objected to the exclusion of Jacques Loeb, one of the world's most distinguished biologists. Professor Edwin R. A. Seligman, the prominent economist, had also been blackballed, and there were in addition to Loeb three other members of the National Academy of Sciences ineligible to membership through race. Yet the Century Club has now brought action in the courts to obtain exemption from taxation on the ground that it is not a social club but an institution devoted to literature, art and science.²

We have in America a great race, brought here by force and forming 10 per cent. of the population, to which we do not give political, legal, social or economic equality. We are in no position to play the part of Pharisees, but we can try to better the situation by giving opportunity to those of exceptional ability who are unable to continue their work elsewhere. In 1910 (*SCIENCE*, November 4) I wrote:

There were 126 foreign-born men of science on the list of 1903. While the majority came to this country

before attaining scientific reputation, a large number were called from Canada, Great Britain, Germany and other countries to fill positions in our universities, of whom seven were among our leading hundred men of science. The members of this group have added greatly to the scientific strength of the country, not only by the research that they have accomplished, but also because they have brought familiarity with the educational methods of other nations, and high ideals of scholarship and of the dignity of the career of the scientific man and university professor. It is surprising and truly most unfortunate that while nine leading foreign men of science have returned to their native countries during the past seven years, only one has come to America—one scientific man among seven million immigrants. There is no way by which the abundant wealth of the country could be used to greater advantage than by bringing to it men of promise and men of distinction.

Psychologically we seem not to have abundant wealth just now; but materially we are far richer than we were in 1910. The market value of stocks and bonds has increased by billions of dollars in the course of the past couple of weeks. Why not take by taxation one of these billions and endow in perpetuity 5,000 of the ablest scientific men of the world with \$200,000 each? It would be the most profitable investment ever made.

We have fallen from the high estate when our country offered a refuge to the oppressed of all nations. We have not, however, completely forgotten what we owe to Puritans and Quakers, to refugees from Germany as recently as eighty years ago. Can we not now provide for those of exceptional ability who, owing to race or political views, are unable to do at home work of value to the whole world?

J. McKEEN CATTELL

QUOTATIONS

THE SITUATION OF JEWISH SCIENTIFIC MEN AND PHYSICIANS IN GERMANY

THE political significance of Nazi revolutionary supremacy under Herr Hitler in Germany is outside our field; but the treatment of the Jewish learned and professional classes stands condemned in the eyes of the intellectual world. It is a relapse to the crass repression of the Germany of Heine's day and the *Judenhetze* of Prussia fifty years ago. An outstanding case is the resignation by Professor James Franck, Nobel prizeman with G. Hertz for physics in 1925, of his chair in experimental physics in the Uni-

² This note may go too far in the direction of autobiography, but illustrations can best be drawn from personal experiences, which have not been lacking. When I have been asked by publishing houses to write an autobiography, I have replied that it would give them too many libel suits.

versity of Göttingen. Professor Franck, it is said, probably would have been spared the forced retirement now operative against Jewish officials, including university professors; but he feels that Germans of Jewish descent are being treated as foreigners and foes of the Fatherland, and asks to be released from his office. Professor Franck served with distinction during the war and received the Iron Cross of the First Class. His action follows fittingly on the retirement of Professor A. Einstein from Germany, and is the logical, indeed the only, reply for a man of his standing to the acts by which Jews are being excluded from the liberal professions and debarred from the universities. This is the achievement of a movement which, ever since the war, has sought to mould the German people to one pan-Teutonic pattern—in ac-

cord with neither the facts nor the conclusions of ethnology. In the denial of a part in Germanic culture to any element alleged to be foreign, Jews, liberals and socialists are to be treated alike; but Jews have suffered most.

The Jewish people need no one to hold a brief on their behalf. The contribution of the Jews to the growth of civilization in the Western world speaks for itself. There were Jews in Germany in Roman times, and wherever they were found in medieval Europe, in spite of, or perhaps because of, their disabilities, they were laying the foundations upon which the modern system of finance and commerce was built up. In Italy as bankers, they rivaled the great houses of Lombardy. In the liberal arts, the preservation of much of classical literature and philosophy was due to them. In the later Middle Ages they were largely responsible for the reputation of Spain as a center of intellectual and scientific development. In the middle of the eighteenth century the revival of Jewish learning, which had Mendelssohn for its inspiration and leader, paved the way for the Jewish people to take its place in the intellectual life of the respective countries of their adoption as their disabilities were gradually removed, so that Bunsen could say that in the German universities of his day the greater number of the principal professors were Jews. Everywhere the Jews have won to preeminence in literature, in the arts, especially music, and the drama. Even if it were not admitted that the Jews had contributed to Germanic culture—a contention which could not be accepted without argument—in the world of learning and science it is to men such as Oppert, the classical scholar, Benfey, the Orientalist, and Heinrich Hertz, the physicist, to take three names only, selected almost at random, that she owes her international standing, just as much as to any of her sons of purest German stock.—*Nature*.

News items appearing in the issues of the *Münchener medizinische Wochenschrift* and the *Deutsche medizinische Wochenschrift* for the weeks of April 7 to April 21, inclusive, indicate the following actions in Germany against Jewish and other foreign physicians:

An ordinance of the Prussian Ministry of the Interior of March 29 states that foreigners, even those who received their preliminary education in Germany, can no longer count on receiving licenses to practise in Germany.

Control of the five largest associations in charge of sickness insurance has been placed under the federal ministry of labor.

Dr. Gerhard Wagner, Munich, first chairman of the National Socialist German Physicians' Organization, has been nominated Commissioner of the National

Physicians' Organizations, of the Association of German Physicians and of the German Alliance of Physicians' Societies.

The Supreme German Medical Societies (Die deutschen ärztlichen Spitzenverbände) gave out the following ordinance in accordance with their commissar, Dr. Gerhard Wagner (first chairman of the National Socialist Physicians' Union):

In execution of their resolution to adhere to the spirit and form of the medical societies of the new order, the directors of the Aerztevereinsbund and the Hartmannbund ask their members, with the advancement of German medicine in mind, to take pains immediately to dismiss from committees and boards of directors all Jewish members; all colleagues who can not conscientiously adhere to the new order must be replaced.

Through the directors of the sickness insurance societies it is to be impressed in turn on the directors of the sickness insurance companies and insurance organizations, officials and superintendents to replace immediately Jewish and Marxist confidential consultants.

DR. STAUDER.

I decree that the foregoing regulation be immediately enforced and notification thereof sent me.

DR. WAGNER.

Dr. Frank, surgeon and member of the board of health, director of the hospital at Fürth, was taken in protective arrest. He was replaced by the internist Professor Weigeldt. Dr. Sponheimer, superintendent surgeon, was granted leave of absence.

The Universities of Leipzig and Bavaria have decreed that no member of the Jewish race will be permitted to matriculate in medicine for the next ten semesters. Enrolment of students for the study of medicine at the University of Munich is to be cut down to 345, at Würzburg to 130, and at Erlangen to 98. Under the terms of these regulations, any one who had one parent or one grandparent of Jewish race is considered Jewish.

The annual session of the German Society for Internal Medicine was scheduled to meet this spring under the presidency of Professor Lichtwitz of Berlin. He resigned from his office and was replaced by Professor A. Schittenhelm, of Kiel. At the forty-fifth Congress of Internal Medicine in Wiesbaden, Dr. Schittenhelm, successor to Dr. Lichtwitz, stated that differentiation must be made between old settled German-Jewish families of high culture and recently arrived eastern Jewish elements, since it is only the latter who bring about a racial taint by intermarriage with Germans. "Men like Ehrlich, Neisser, Minowski and Wassermann," he said, "should be given great respect by German physicians and people of

their talent would in the future undoubtedly be able to succeed in Germany."

In Baden, all Jewish physicians have been dismissed from the public health service and from the sickness insurance organization. In the hospitals they are permitted to treat only Jewish patients and to perform postmortem examinations only on Jewish patients who have died. A similar regulation has been established in Munich.

In Munich, S. Obendorfer and O. Neubauer requested a leave of absence from the Schwabing Hospital. The following Jewish physicians of the main office of public health in Berlin were given leave of absence: Professor Seligmann, Drs. Borinski, Cohn, Wolff, Nussbaum and others. The Jewish physician-in-chief of the cripple welfare station VII in Char-

lottenburg, Dr. Böhm, was replaced by Dr. Kniekamp of the orthopedic clinic.

The business director of the Berlin ambulatory clinic, Max Edel, and Dr. Friedeberger were placed under protective arrest.

The editor of the *Deutsches Aerzteblatt*, San.-Rat. Vollman, was given a leave of absence by the chairman of the Deutscher Aerztevereinsbund. Dr. K. Walder, of Potsdam, takes his place.

The Committee on Therapeutics of the German National Society of Physicians has made public a list of pharmaceutical preparations manufactured by concerns under Jewish ownership or control with the request that physicians in general do not prescribe such preparations.—*Journal of the American Medical Association*.

THE NATIONAL ACADEMY OF SCIENCES

ABSTRACTS OF PAPERS PRESENTED AT THE WASHINGTON MEETING. II.

(Continued from page 460)

The Woods Hole Oceanographic Institution: HENRY B. BIGELOW. A report is presented to the academy on the history and present activities of the Woods Hole Oceanographic Institution, giving the events leading to the establishment of the institution; reasons for the choice of Woods Hole for the site for its headquarters; descriptions of the laboratory, of the scientific equipment and of the research ship *Atlantis*; the general organization, staff, facilities for visiting investigators, cooperation with other institutions and plans for publication; the reasons for adopting a directed and coordinated program of research; and a summary of investigations now in progress and of the cruises of *Atlantis*.

The bearing of genetics on the theory of evolution: THOMAS HUNT MORGAN.

Phenomena associated with cosmic rays: W. F. G. SWANN (by invitation). Certain of the investigations in progress at the Bartol Research Foundation in the field of cosmic rays have been summarized by the author and in particular the following were described: (1) Observations of cosmic ray atomic disintegration made simultaneously by ionization methods and by counter methods. (2) Experiments dealing with the detection of individual cosmic rays by direct measurement of the ionization which they produce. These experiments lead to the determination of the ionization per centimeter of path in different gases. (3) Certain possibilities as to the origin of cosmic ray energies, particularly in relation to the origin of electronic cosmic ray energies as a result of electric fields produced by electromagnetic induction in the stars. (4) Observations on electrostatic deflection of secondary cosmic rays.

Cosmic ray intensities in the stratosphere: I. S. BOWEN and R. A. MILLIKAN. By sending up recording electrosopes, barographs and thermometers with the aid of

sounding balloons in accordance with the technique which we first used in 1922, we have, during the past summer, made three successful flights, one of which reached an altitude at which the pressure had fallen to 16 millimeters of mercury—about 99% of the way to the top of the atmosphere—a second flight reached a height of 21 kilometers and the third the height of 16 kilometers. On two of these flights we obtained reliable records of the cosmic ray intensities as a function of altitude up to 18 kilometers, 92% of the way to the top by weight. At this altitude the cosmic ray intensities are approximately 100 times greater than at sea-level, and the intensity altitude curve is of such a shape as to indicate that the rays entering the atmosphere have not yet got into equilibrium with their secondaries. Three flights thus far made, two by ourselves and one by Regener, are in reasonably good agreement.

The penetrating power of cosmic rays as a function of altitude: R. A. MILLIKAN and H. V. NEHER. We have made accurate airplane observations with our new electrosopes, so designed as to give as accurate readings on moving platforms as in a laboratory, reaching altitudes above 29,000 feet. Up to this altitude we have taken readings both without lead shields and with a lead shield, and have thus obtained direct measurement of the penetrating power of the cosmic rays existing in different levels. These rays show a rapid softening with altitude, and essentially the same softening in temperate latitudes as in equatorial latitudes. The observed behavior seems to us to be best interpreted in terms of cosmic ray photon bands of widely differing penetrating power, the less penetrating bands coming into play at the higher altitudes.

The magneto-optic method of analysis and some recent applications: FRED ALLISON (introduced by Arthur L.

Day). A very brief outline is given of the magneto-optic method of analysis, the apparatus and its manipulation. The method detects compounds of both inorganic and organic substances. It has proved itself a tool of value in certain problems in qualitative and quantitative analysis, particularly those concerned with compounds existing in very small concentrations, the sensitivity being of the order of several parts in 10^{12} and the results being unaffected by the presence of foreign materials. Observations are made on minima of light intensity, the scale readings of which are characteristic of the compounds and are measures of differential time lags in the reaction of the compounds to the applied magnetic fields. The time lags are functions of the combining weights of both the cation and the anion. The method determines the number and the order of abundance of the isotopes of the cation but not of the anion. The scale readings are reproducible by the same and different observers (including the work during the past five years of some fifteen observers on the same and different sets of apparatus) to within about 3 mm, corresponding to 0.01 scale division and to a time lag of 10^{-11} sec., while quantitative results can be obtained within an error of 10 per cent. The more recent progress of the work is described, namely, the isotopic constitution of some of the radioactive elements; the isotopes of beryllium and zinc; a slight temperature effect on sensitivity; and investigations on the problem of mutual isotopic influence. Mention is made of a new quantitative technique developed by Professor E. R. Bishop and her students and also of the application of the method to a problem in photosynthesis by Dr. A. L. Sommer.

The discovery of the free positive electron: CARL D. ANDERSON (introduced by Robert A. Millikan). During a systematic study by means of a vertical Wilson cloud-chamber of the high energy particles associated with the cosmic radiation, evidence was uncovered which led to the striking conclusion that the free positive electron, heretofore unknown, was present among the cosmic-ray particles. By placing a horizontal lead plate across the center of the cloud-chamber for the purpose of studying the interaction of cosmic-ray particles with matter, photographs were obtained which could be interpreted logically only on the basis of the existence of a particle with positive charge of a magnitude less than twice that of the electron and probably exactly equal to it, and a mass comparable to that of the free negative electron. From the occurrence of the free positive electrons with groups of other tracks it is concluded that they result from disintegration of atomic nuclei. The term positron is suggested to denote the free positive electron when it occurs unassociated with a mass of atomic magnitude. The cloud-chamber, planned in the summer of 1930 by Professor R. A. Millikan and the writer, operates in a uniform magnetic field up to 18,000 gauss. Exposures are automatically taken at the rate of one in 14 seconds. Out of a total of about 25,000 exposures, 1,450 photographs of cosmic-ray tracks have been obtained, which have yielded the following facts. Particles of both positive and negative charge occur in about equal num-

bers. Their energies range from above a billion volts in a few cases down to energies of a few million volts and less. Groups of associated tracks of both positive and negative particles occur (in our photographs as many as 12 tracks on one photograph) indicating the disintegration of atomic nuclei by the cosmic-radiation; the detailed mechanics of the absorption of the cosmic-radiation is very complex and at present not clearly understood. P. M. S. Blackett and G. Occhialini, using an automatic (tube-counter controlled) cloud-chamber, have obtained additional evidence for the existence of the free positive electron.

Semi-conductors and their electrical properties: R. H. FOWLER. By invitation.

Perfect quality and auditory perspective in the transmission and reproduction of music: F. B. JEWETT. [Printed in SCIENCE for May 12.]

Radioactivity and the light nuclei: R. M. LANGER and R. W. RAITT (introduced by Robert A. Millikan). The fact that the beryllium atom is unstable and disintegrates spontaneously is now established on the basis of the following evidence: (1) Purified Be metal in an ionization chamber produces a current which is about two times as great as that supplied by the thorium family contamination and a hundred times as great as that of the radium family contamination. The Ra and Th measurements were made with the double chamber emanation method capable of detecting an alpha activity one hundred times smaller than that shown by the Be. (2) The range of the particles, assumed to be alpha rays, is about one centimeter, according to Al foil measurements. This range is decidedly shorter than that of any possible contamination. (3) The helium content of beryllium minerals is out of proportion to the uranium and thorium content, but is quite consistent with the rate of decomposition which we have estimated with ionization chamber methods. (4) The excess in mass of Be, over the mass of two helium atoms and a neutron indicates on very general grounds that it is unstable. If the current theory of alpha-particle disintegration is applied to the case of Be, one finds a decay rate over 10^{30} times larger than that observed. However, this theory is not a general quantum mechanical deduction but depends on a model which pictures the nucleus as a composite of alpha particles. Apparently we must conclude that the Be nucleus is not composed of alpha particles. This is quite in accord with the modern theory of nuclear structure, which has had considerable success with the hypothesis that the structural units of the nucleus are the proton and the neutron.

An ionization spectrometer for long wave-length x-rays: F. K. RICHTMYER and S. KAUFMAN. Much of our knowledge of the x-ray spectrum in the region of wave-lengths longer than 1.5 Angstroms comes from photographic measurements. However accurate may be the values of the wave-lengths of spectrum lines determined by photographic means, such measurements are not very trustworthy in determining the shapes and relative intensities

of lines and in measurements which involve the determination of x-ray energy. Because of the many problems awaiting study in the long wave-length x-ray region, we have adapted the Siegbahn high-vacuum spectrometer for ionization measurements, using the usual single crystal method. The easily attainable resolving power is such as to give observed widths of the $K\alpha$ lines of Cu(29) only a few per cent. wider than when measured by a two-crystal instrument. There seems to be no difficulty in using this instrument to make ionization-chamber measurements up to 5 or 6 Angstroms, or longer.

A test of the "momentum transfer" theory of accommodation coefficients of ions at cathodes: K. T. COMPTON and E. S. LAMAR. In a recent paper, read before the National Academy of Sciences, it was suggested that the accommodation coefficient for positive gas ions on a metal cathode should be less than unity only if the mass of the metal atom exceeds that of the ion. In order to test this hypothesis, experiments already reported for helium ions on molybdenum have been continued for argon ions on molybdenum and on aluminium. The cathode to be studied was the molybdenum or aluminium bob of a glass pendulum, whose deflection gave a measure of the pressure acting, and was immersed in the positive column of a low voltage argon arc. The pressures on the cathode were due to the recoil of those ions which retain some of their kinetic energy after neutralization and to radiometric effects resulting from heating of the cathode by ion bombardment. From an analysis of the data, it was possible to compute an accommodation coefficient for the positive ions. The results indicate an accommodation coefficient of about .79 for argon ions on molybdenum, and an accommodation coefficient of unity on aluminium.

Evidence that acidosis is not caused by acids: YANDELL HENDERSON and LEON A. GREENBERG. In recent years acidosis has been one of the most largely discussed topics in relation to illness. This condition, or group of conditions, is important. But the explanation that is now generally accepted is shown by the investigations to be reported in this communication to be erroneous. It is now supposed that the condition called acidosis arises from an excessive formation of acids in the body. This increased formation of acids is supposed to explain the great decrease of sodium bicarbonate and other alkalies in the blood. The acid chiefly concerned is lactic acid. The amount of this organic acid is increased under severe deficiency of oxygen, as in carbon monoxide poisoning, in which an asphyxial "acidosis" develops. It has recently been shown by Lundsgaard in Denmark that animals which are given a small dose of the drug moniodoacetic acid are rendered incapable of producing lactic acid. Accordingly, in the investigations to be reported to the academy animals were first treated with this drug, and then subjected to such conditions (deficiency of oxygen) as have been found to induce a state of so-called acidosis. The result was that all the features of that state, particularly the diminution of bicarbonates in the blood, were developed, but without the formation

of any increased amount of lactic acid. The conclusion that the state called "acidosis" is not due to intoxication by excessive formation of acid in the body is in accord with the fact that the administration of alkalies to patients with acidosis, as in diabetes, has not been found beneficial and has been generally abandoned. The theory that "acidosis" is intoxication by acid is an apparently logical deduction from the conception now prevailing as to the nature of the acid base equilibrium of the blood. It is, however, definitely contradicted by facts, and some other theory will have to be developed.

Cellular reactions to lipoids from acid-fast organisms: FLORENCE R. SABIN and KENNETH C. SMITHBURN. The lipoids in acid-fast organisms can be separated into three classes, phosphatides, fatty acids and wax-like materials. The phosphatides are an important factor in the production of the lesions of tuberculosis. They are readily dispersed in water, a property which makes it easy to test their biological reactions. They are phagocytized by monocytes which, in dealing with them, become epithelioid cells. The fatty acids, represented largely in the acetone-soluble material, stimulate all types of connective tissue cells, cause vascular dilatation and hemorrhage and induce adhesions. The wax-like materials have long been considered of great importance because they are responsible for the acid-fastness of the organisms. The wax-like material of the human tubercle bacillus is an alcohol, $C_{24}H_{48}O_2$; the corresponding material from an acid-fast organism isolated from a case of leprosy is a glyceride. These materials can not be wet with water, a property which may account for the fact that the cells deal with them in a manner different from phagocytosis. The purified substances injected in the form of a dry powder cause a multiplication of young connective tissue cells around the particles. These cells are simpler than monocytes and show no signs of being able to phagocytize the wax-like material, but rather they fuse to make foreign body giant cells to surround it. There are then signs of a change in the material which, at first opaque and granular, becomes globular and translucent. If the phosphatide has not been completely removed from the material injected, the monocytes are able to separate it from the wax. These cells then show signs of phagocytosis and become epithelioid cells. Since a single lipoidal substance gives only one type of cellular reaction, the biological tests offer a check on the degree of separation of the lipoids. Although foreign body giant cells occur in tuberculosis, it is probable that they are an accessory phenomenon in the progress of the disease and that the wax-like materials by which they are produced may be classified as biologically inert.

(To be concluded)

BOOKS RECEIVED

- JOCHELSON, WALDEMAR. *History, Ethnology and Anthropology of the Aleut*. Pp. v+91. 27 figures. Carnegie Institution of Washington.
- NEAVE, S. A. and others. *History of the Entomological Society of London, 1833-1933*. Pp. xlv+224. The Society. 10s. 6d.